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Journal of the Society of Arts.

FRIDAY, DECEMBER 17, 1869.

Announcements by the Council.

ORGANISATION OF TRAINED TEACHING POWER FOR NATIONAL EDUCATION.

The attention of the members, and of all those specially interested in the National Education question, is particularly requested to the copy of the instructions given to the deputation from the Council to the Birmingham Education League, and to the Manchester Education Union, forwarded as a supplement to this week's *Journal*, as containing an exposition of means for extending Science and Art instruction to the whole of the children of the middle classes, as well as the artizan class, throughout the country. This, it is now demonstrated, may be accomplished by shortening the time generally occupied in elementary instruction, and by improving the quality of that instruction, by improved and augmented teaching power. Especial attention is requested to the information appended to the document, derived from the highest sources, displaying practical examples of the means of accomplishing that object without increased expense, by division of educational labour, and by different applications of trained teaching power, which, in this country, are as new in principle as they are important for the consideration of the question of national education and progress. Examination is requested of the evidence of the different results of the application of one and two teacher power in one class of schools, as compared with the results obtained from the application of six, eight, or ten teacher power or more in a class of schools of a higher degree of organisation. A further illustration of the application of trained teaching power, which, in education, may be said to be like a new application of power in mechanics, is presented in this week's *Journal*, of the application of a seventeen trained-teacher power of the first class to the advancement of the pupils of the City of London Middle Class Schools, where it will be seen that, by an improved organisation, promoted by the Rev. W. Rogers, a member of the Council, an extent of science and art culture is imparted by the end of the fourteenth year that is not at present commonly attained, in the adult stages, in public schools, or in the most expensive private schools.

The Council, under the conviction of the great importance of the principle for science and art and national education, is endeavouring to obtain other practical examples of the means of

applying it under varied conditions, in rural as well as in urban districts.

LOCAL SCIENCE COLLEGES.

The meeting called by the circular published in the last *Journal* (p. 61) takes place at Manchester this day (Friday), and the Secretary has been instructed to accompany such members of the Council as may be able to attend. The following document, expressing the views of the Council, will be read to the meeting:—

1. The Council of the Society of Arts have received a communication from Owens College Extension Committee, Manchester, asking their co-operation in the extension of technical education, or, more properly, Scientific Instruction; and it affords them much pleasure to do whatever lies in their power to advance this important national object. With this view, the Council have invited the members of the Society, and especially those resident in the locality, as well as the authorities of Owens College, to meet them in conference on the subject, to discuss the best means by which scientific instruction may be promoted, and to establish an organisation which will keep an influence at work to accomplish what is so urgently needed.

2. The necessity and importance of improved scientific instruction for the people of the United Kingdom, in order that they may be placed in a favourable position in the race of industrial competition with other nations, has, for some time past, been forced upon the notice of the Society of Arts, whose chartered objects are the Promotion of Arts, Manufactures, and Commerce.

3. The great international displays of industry in 1851, 1855, 1862, and 1867, have shown unmistakably that, if this country is to maintain her position as a commercial and manufacturing power, the people (and in this term are comprehended not only artisans, but also persons of higher position in the social scale) must have at their command the means of education improved in its general character, and embracing, if not based upon, science to a far greater extent than has hitherto been the case. The official jury reports at all the exhibitions abound in declarations of this character, and the country can no longer afford to ignore the fact, but must earnestly set to work to bring about a change. These reports, as well as those of the artisans who were sent to the Paris Exhibition of 1867 by the Society, one and all point out the great educational facilities which are available for all classes, and especially the artizan class, upon the Continent.

4. The Council are of opinion that existing schools and colleges, where science has hitherto been all but excluded, should adopt some means for its being taught; and that where such teaching already exists, measures should be taken for extending the usefulness of the institutions, and rendering them more easy of access to the great body of the people; whilst in localities where no such facilities exist, means should be taken to secure their foundation. The localities must themselves stir in this reform, and their efforts should be aided by pecuniary assistance and countenance by the State.

5. The nation must set itself earnestly to work to bring about the sought-for change in the education of the people. The evils have been so often pointed out, that it is unnecessary to enter into detail; our duty is to supply the remedy. This the Council believe to be by the localities setting themselves heartily to work, and when they have shown themselves in earnest by raising funds and organising establishments for the teaching of science, they should be entitled, as of right, to aid from the State.

6. In order, however, that such establishments, colleges, or schools should be of value to the mass of the people

so that they can take advantage of the facilities which would then be offered to them, it is absolutely necessary that elementary education, commonly known as primary education, should be extended far more widely than at present. To an ignorant population the establishment of colleges and schools for the teaching of science will be of little avail, and unless the blessings of an ordinary elementary education, *i.e.*, reading, writing, and arithmetic, at least, can be more diffused, so as to place our people on a par with those of Switzerland, Prussia, Saxony, &c., the attempt to extend the teaching of science will be in vain. Again, not only must we have improved elementary education, but these elements must themselves be taught by improved methods and organisation, so that less time may be occupied in acquiring them, thus leaving free for the learning of elementary science some of those years which are now unnecessarily taken up in mastering the mere rudiments of knowledge. Abroad, it is the custom of the state only to deal with this and many other matters of public concern, but such is not the case here. The Council do not recommend state interference as of choice, but of necessity. This work of education must be done, and it will have to be done wholly by government if not otherwise. Experience proves that it can be done by a combination of voluntary efforts, with government aid, as in the existing system of primary education, and in the instruction aided by the Science and Art Department. The Council think that the work is to be done in part nationally, in part voluntarily, but not upon a hap-hazard system.

7. Adam Smith, the earliest, and, perhaps, the first English writer on political economy, as well as Mr. J. Stuart Mill, its present most able exponent, recommend scientific instruction as profitable to the nation. Her Majesty's Government must not plead economy as an excuse, for the highest and wisest economy comes out of wise expenditure.

8. The Council believe that this is the feeling of the country, which the government will regard with respectful attention. Government must be urged to co-operate with Owens College and other bodies, either existing or to be established. Parliamentary grants are now made to the old universities of England and Scotland, and to the Queen's Colleges in Ireland, and there is no reason why the same principle should not be extended, and grants made to modern educational establishments in the great centres of industry. The Council are of opinion that a government resulting from a wide representation of the whole people ought adequately to represent the highest intelligence and aspirations of that people for improvement, and not limit its responsibility and its labours to matters of police. There can be no more profitable investment of national capital drawn from taxes paid by the whole nation, than in promoting the best education among all classes of the people, and the widest extension of sound knowledge, on which the Arts, Manufactures, and Commerce of a kingdom rest.

(By order)

HENRY G. LENNOX, *Chairman*.
P. LE NEVE FOSTER, *Secretary*.

COLLECTION OF ENGRAVINGS AND PRINTS.

The collection of prints produced by various processes, used to illustrate Mr. Davenport's paper, "On Prints and their Production," read on Wednesday evening, the 8th instant, will be open for the inspection of members and their friends, between the hours of 10 and 4 o'clock, up to Saturday, the 8th January, 1870, inclusive.

Tickets for members' friends are forwarded with this week's *Journal*.

ORDINARY MEETINGS.

Wednesday Evenings at eight o'clock:—

DECEMBER 22.*—"On Wines, their Origin, Nature Analysis, and Uses; with special reference to a new Alcoholic Drink made from Tea." By J. L. W. THUDICHUM, Esq., M.D. On this evening A. W. WILLIAMSON, Esq., F.R.S., Professor of Chemistry in University College, London, will preside.

CANTOR LECTURES.

The second lecture of the course "On the Spectroscope and its Applications," by J. NORMAN LOCKYER, Esq., F.R.S., was delivered on Monday evening last, the 13th inst. The third and concluding lecture will be delivered on Monday evening, the 20th inst., at Eight o'clock. The whole course of lectures will be published in the *Journal*.

DONATIONS TO THE LIBRARY.

The following work has been presented to the Library, and the thanks of the Council have been communicated to the donors:—

The Lord's Prayer, illustrated. By Henry Alford, D.D., and F. R. Pickersgill, R.A.; presented by Messrs. Longmans, Green, and Co.

SUBSCRIPTIONS.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of the Society.

INDIA COMMITTEE.

The second Conference of the Session was held on Friday evening, December 10th, W. S. Fitzwilliam, Esq., late member of the Supreme Legislative Council of India, in the chair. The paper discussed was by Andrew Cassels, Esq., on "A Gold Currency for India." On the motion of Dr. Boycott, the discussion was adjourned to Friday evening, January 28th, 1870. A report of the proceedings will appear in a subsequent number of the *Journal*.

FIFTH ORDINARY MEETING.

Wednesday, December 15th, 1869; Dr. BERTHOLD SEEMANN, F.R.G.S., F.L.S., in the chair.

The following candidates were proposed for election as members of the Society:—

Bowles, Thomas G., 88, St. James's-street, S.W.
Marchant, William J., 106, Great Russell-street, W.C.
Olsson, Martin, 69, Richmond-road, Barnsbury, N.

* Captain O'Hea's paper on "Recent Improvements in Small Arms" is postponed till after Christmas.

The following candidates were balloted for, and duly elected members of the Society:—

Ford, Stephen, Vestry Offices, Bermondsey, S.E.
 Giles, Francis G., Clatsford, Andover.
 Ikin, Alfred, Eccleston, Cheshire.
 Mackie, Samuel J., 84, Kensington-park-road, Bayswater, W.
 Pooley, T. A., South Side, Clapham-common, S.W.
 Tyler, Captain, Board of Trade, S.W.

The Paper read was—

ON INDIA-RUBBER, ITS HISTORY, COMMERCE, AND SUPPLY.

By JAMES COLLINS, Esq.

(Curator of the Museum of the Pharmaceutical Society, Fellow of the Edinburgh Botanical Society.)

In 1867, I read before the Society of Amateur Botanists a paper on the "Commercial Kinds of India-rubber or Caoutchouc." This, after I had somewhat amplified it, was published in Dr. Seemann's *Journal of Botany* for January, 1868. Since that period I have been instituting inquiries abroad, and at the present moment am waiting for material from several parts of the world. When your worthy Secretary asked me to read a paper here, I gladly acquiesced, trusting that it may be the means of introducing the subject more thoroughly to the notice of those who from residence, mercantile connections, or other equally advantageous causes, may be induced to assist me in my further researches, with the result, I hope, that the supply of this useful article will be much augmented. On the present occasion, I shall restrict myself to the history of the raw product, apart from its manufacturing interest. For the better understanding of our subject, I propose to treat of india-rubber under four geographical groups, viz:—1. American; 2. Asiatic; 3. African; 4. Australian; closing by a few general remarks on the whole question.

For the purpose of illustration I have on the table specimens of nearly all the different kinds of india-rubber, as also dried specimens of a few of the plants by which they are produced. Before proceeding, however, I must express my best thanks to Mr. Henry Norris, of Edinburgh, and Messrs. J. H. Rayner and Co., of Liverpool, for specimens they have unsolicited sent me, forming a very welcome addition to my collection.

I.—AMERICAN KINDS OF INDIA-RUBBER.

Of the early history of American caoutchouc we have very interesting accounts. Among the earliest is that of Herrera,* who, in his account of Columbus' second voyage, speaking of the natives of Hayti, says:—"They had other amusements, such as the game of ball, for which they had a house set apart, and they played it so many on each side, without sticks or bats, for they struck the balls with any part of their bodies, and with great dexterity and nimbleness. And the balls were of the gum of a tree, and, although large, were lighter and bounced better than the wind-balls of Castile." Juan de Torquemada, however, seems to be the first who mentions the tree yielding this substance, viz., the ulequahuil, or *Castilleja elastica*, Cerv. In his "De la Monarquia Indiana" (tom. 2, cap. xliii., p. 663), published at Madrid in 1615, when speaking of Mexico, he says:—"There is a tree which the Indians call Ulequahuil; it is held in great estimation, and grows in the hot country. It is not a very high tree; the leaves are round and of an ashy colour. This tree yields a white milky substance, thick and gummy, and in great abundance. To obtain it, the tree is wounded with an axe or cutlass, and from these wounds the liquid drops. The natives collect it in round vessels of different sizes, called, in their language, "xicalli," but by us calabashes. In

these they allow it to settle in round balls, of the size most convenient for the purposes to which they are about to apply them. When quite set they boil them in water, in which state the gum is called "ulli." The Indians who have got no calabashes smear their bodies over with it (for Nature is never without a resource), and when it becomes dry they remove the whole incrustation, which comes off in the form of a very smooth membrane, its thickness depending on the will of the party collecting. They then make it into balls and boil them as before. Anciently, they used to play with these balls, striking them against the ground, and making them rise to a great height. But in the game of pelota it was not struck against the ground, but caught upon the hip or shoulder. From the ulli an oil is extracted of great value in various applications. It was formerly much used by the natives, nor have they forgotten its properties now, for it is soft and lubricous, and of especial effect in removing any tightness of the chest. The oil is extracted from the ulli by heat; it starts out in a manner to excite admiration, leaving nothing to compare it unto. The oil is drunk mixed with cocoa, and, indeed, it softens any other medicine, however hard its quality. It is also found of great advantage in stopping hæmorrhage, for which it is taken internally. The coagulated ulli is so strong in itself, that a breastplate made of it no arrow will pass through; for, being of a nature leathery and membranous, it ejects the point. The kings and nobles were accustomed to make shoes of the ulli, and to order the fools and jesters, the humpbacked and dwarfs of the palace, to be shod therewith, in order to make them sport, for the wearers could not step without falling, which, with their awkward actions, gave rise to much jesting and merriment. Our people (*i.e.*, the Spaniards) used it in waxing their cloaks, which were made of coarse canvas, so as to make them resist water; and, in truth, it is of great effect in resisting the water, but not so the sun, for the rays thereof melt it."

To M. Charles Marie de la Condamine we are indebted for our first accurate information respecting the india-rubber furnished by the different species of *Hevea*, or *Siphonia*. In 1735, this gentleman, together with three fellow members of the French Academy, started on an astronomical mission to South America. He found here seringa trees in great abundance. When writing of them, he says:—"The rosin named cahout-chou in those countries of the province of Quito adjacent to the sea, is very common also on the banks of the Marañon, and serves for the same uses. When it is fresh, they work it with moulds into what shape they please, and it is impenetrable by the rain; but what renders it most remarkable is its great elasticity. They make bottles thereof which it is not easy to break; boots and hollow bowls, which may be squeezed flat, and, when no longer under restraint, resume their first form. The Portuguese of Para have learnt of the Omas to make squirts or syringes thereof that have no need of piston or sucker; they are made hollow, in the form of a pear, when scooped, having a little hole at the small end, to which a pipe of the same size is fitted; they are then filled with water, and, by squeezing them, they have the same effect as a common squirt! This machine is mightily in vogue among the Omas; when they meet together by themselves for any merry-making, the master of the house never fails to present one to each of his guests; and the use of the squirt with them is always the prelude to their most solemn feasts." I do not suppose there is any likelihood of this custom being introduced into our country. This use of the ulli led to the Portuguese name, "Pao di Xirringa."

After Condamine left America, M. Fresnau, an engineer, who had lived for many years at Cazenove, in Guiana, turned his attention to the subject, he having seen various articles made of india-rubber brought to Para, and became very anxious to discover the tree from which the substance was obtained. For this purpose, failing to

* Herrera, Historia, decada 1., libro iii., cap. iv.

get information from the Indians at Para, he at last obtained clay models of the fruit of the tree; these he distributed among his correspondents, with the inquiry whether they knew of a tree having such a fruit. This plan, as it deserved, met with success, and he had the satisfaction of making himself various articles, such as boots, bottles, &c., of the rubber. An account of his researches was published by the French Academy in 1751.

To M. Fusc Aublet, the distinguished French botanist, we are indebted for a description of *Hevea Guayanensis*. In his "Flora of Guiana," published in 1755, he says that the fruit is much sought after by the natives for food, and that caoutchouc is collected in the following manner:—"The natives begin by making, at the bottom of the trunk, a deep gash, which penetrates into the wood. They then make another incision, from the upper part of the trunk, vertically downwards to the former one, and at various distances a number of oblique incisions are made, running into the first. These incisions form channels for the oozing sap, and convey it into a vessel placed for this purpose at the foot of the tree. In this the sap collects, loses its moisture, and becomes a soft elastic mass, which, when quite fresh, is readily made to take the shape of any instruments or vessels upon which it is applied layer by layer. The moulds are sometimes made of unbaked clay, and are then removed by pouring in water, which softens them, so that the caoutchouc alone remains. Sometimes they are made of baked clay, and are removed by being broken in pieces, the elasticity of caoutchouc enabling it to bear the violence necessary without injury to its structure."

We now pass to the consideration of the different kinds of American caoutchouc. These we may treat in geographical order.

BRAZIL.

Of all the kinds of india-rubber known to us, that of Brazil is most highly esteemed. Of Brazilian rubber there are four kinds we may mention, namely, Para, Maranhão, Ceará, and Pernambuco.

Para.—The rubber known as Para is the best and most valuable kind, fetching a higher price than any other rubber in commerce. It is one of the most important articles of trade at Para, the duty on it being equal to one-third of the whole revenue. Para rubber is the produce of *Hevea Guayanensis*, Aubl. (being the same plant as the *Siphonia elastica*, Pers. and the *S. cahuchu*, Willd.) and other species of the same genus. These trees are found abundantly in the provinces of the Amazons and of Para, less common in Maranhão, and in large quantities in Ceará and the Rio Grande do Nord, frequenting the river banks and marshy places. Through the perseverance and industry of Dr. Spruce, we are in possession of much accurate information respecting these trees and their produce. In a paper by Mr. George Benthām, on plants collected by Dr. Spruce, the following notes occur:—

"*Siphonia Brasiliensis*, Willd. (*Hevea Brasiliensis*, Muell.). In the forests of Para. A lofty handsome tree, branching from the base, and yielding the caoutchouc the most abundantly exported."—*R. Spruce*.

"*S. lutea*.—From the forests of the Rio Uaupés. A tree of 70 feet; the milk copious, speedily turning black, and staining linen permanently. When dry, elastic and very tenacious."—*R. Spruce*.

"*S. discolor*.—Scarcely elastic when dry."—*R. Spruce*.

"*S. paucifolia*.—A large tree, 40 to 50 feet high, yielding a copious milky juice."—*R. Spruce*.

"This genus seems abundant throughout the Amazon, but not all the species yield caoutchouc (or xiringue, as it is here called) of good quality, those of the Gapó and Caatinga producing a brittle gum."—*R. Spruce, ms.*

In a paper on the india-rubber of the Amazon, Dr.

Spruce says:—"On the upper Rio Negro and lower Casiquiare are two species—*Siphonia lutea*, Spr., and *S. brevifolia*, Spr., known respectively as the long-leaved and short-leaved seringa. The former yields most milk, but neither are so productive as the seringa of Para (*S. Brasiliensis*.) Both are straight, tall, and not very thick trees, with smoothish, thin bark, and yellow, very odoriferous flowers. I suppose their average height may be about 100 feet. I cut down a tree of *S. brevifolia*, near San Carlos, which measured 110 feet. I first saw and gathered *S. lutea* in the mouth of the Uaupés; and as I came down the Rio Negro in December, 1854, found a rancho erected on the spot, and a person employed in extracting rubber from the same trees as I had taken the flowers."

Dr. Spruce, in a letter dated October, 1867, kindly favoured me with the following information:—"Caoutchouc is obtained at Para, from *Siphonia (Hevea) Brasiliensis*, Willd. (and probably from several other species); on the Amazon, about the mouth of the Tapajoz, from *S. Spruceana*, Bth.; on the Amazon, towards the mouth of the Madeira, are other species, not seen by me in good state; on the Rio Negro, Uaupés, and Casiquiare, from *S. discolor*, Spruce, *S. rigidifolia*, Spruce, *S. lutea*, Spruce, *S. pauciflora*, Spruce, and *S. apiculata*, Spruce."

Very interesting accounts of these trees, together with the mode of collecting the rubber, have been given by travellers.

Edwards,† speaking of one of the many islands to be found in the Amazon River, says:—"This island was covered with a fine forest, in which were abundance of seringa trees, all scarred with wounds; we made some incisions with our tresados, and the milk oozed out, and dripped in little streams. Its taste was agreeable, something like sweetened cream, which it resembles in colour. These trees were often of a great height, and from two to three feet in diameter; the trunks were round and smooth, and the bark was of a light colour, and not very smooth; the wood was soft, and we easily cut off a large root, and brought it away with us. The top of the seringa is not very wide-spreading, but beautiful, from its long leaves, which grow in clusters of three together, and are of oblong, ovate shape, the centre one more than a foot in length, and the others a little shorter. We found also the fruit of the seringa; it is ligneous; the size of a large peach, and divided into three lobes, each of which contains a small black nut."

And, again, Mr. Bates says:—"In descending the river [Rio Toncantins], leaving Baiao, we took our last farewell of the limpid waters and varied scenery of the upper river, and found ourselves again in the humid flat region of the Amazons valley. We . . . frequently went ashore on the low islands in mid river. . . . These are covered with water in the wet season, but at this time, there having been three months of fine weather, they were dry. . . . They are covered with a most luxuriant forest, comprising a large number of india-rubber trees. We found several people encamped here, who were engaged in collecting and preparing the rubber, and thus had an opportunity of observing the process. The tree which yields the valuable sap is the *Siphonia elastica*. . . . It grows only on the low lands in the Amazons region; hitherto the rubber has been collected chiefly in the islands and swampy parts of the mainland, within a distance of fifty to a hundred miles to the west of Para; but there are plenty of untapped trees still growing in the wilds of Tapajoz, Maderia, Jurua, and Jauri, as far as 1,800 miles from the Atlantic coast. The tree is not remarkable in appearance; in bark and foliage it is not unlike the European ash, but the trunk, like that of all forest trees, shoots up to an immense height before throwing off branches. The trees seems to be no man's property hereabouts. The people we met with told us

* Hooker's Jour. Bot., 1855, p. 193.

† "A Voyage up the River Amazon." New York, 1847.

‡ Bates, Naturalist on the River Amazon. Vol. i, p. 142. 1863.

they came every year to collect rubber on these islands, as soon as the waters had subsided, namely, in August, and remained till January or February. The process is very simple. Every morning each person, man or woman, to whom is allotted a certain number of trees, goes the round of the whole, and collects, in a large vessel, the milky sap which trickles from gashes made in the bark on the preceding evening, and which is received in little clay cups, or in amphullaria shells stuck beneath the wounds. The sap, which at first is of the consistence of cream, soon thickens; the collectors are provided with a great number of wooden moulds of the shape in which the rubber is wanted, and when they return to the camp they dip them in liquid, laying on, in the course of several days, one coat after another. When this is done, the substance is white and hard; the proper colour and consistency are giving by passing it repeatedly through a thick black smoke obtained by burning the nuts of certain palm trees, after which process the article is ready for sale."

More recent information is to be found in a work on Brazil, published at Rio Janeiro, in 1867.* The passage may be translated as follows:—

Crude Caoutchouc.—The milky fluid extracted from the *Siphonia elastica* is known in Brazil under the names of "borracha," "seringa," and "cahuchu," the designation employed by the natives. The juice of the caoutchouc tree contains about thirty per cent. of india-rubber. . . . Caoutchouc is extracted by effecting incisions into the trunk of the tree. A transverse cut is first made of sufficient depth into the bark, a few feet above the root, a perpendicular incision being then made from the trunk down to the cross cut, and, at intervals, inclined cuts into the perpendicular one. This operation is often promoted by binding the tree with cords or bands, which frequently kills it. In a few hours the juice which flows out fills the basins made of large leaves and plastic clay, which are adapted to the lower part of the tree. It is then poured into other vessels of various shapes; in a short time it becomes thickened, and solidifies in consequence of the evaporation of the liquid part. In order to dry it completely, the practice is to expose it to a gentle heat; for this purpose it is suspended over a brasier lighted with wood, and the flame maintained with the fruits of auricuri, in such a manner that it may receive the smoke, hence the blackish colour which the caoutchouc of commerce generally presents. Whilst it is liquid it is fashioned by means of moulds, according to the purposes to which it is destined.

For a considerable time after the discovery of this kind of india-rubber, it remained a mere curiosity. Dr. Priestley, in the preface to his book on "Perspective" (1770), says:—"Since this work was printed off, I have seen a substance excellently adapted to the purpose of wiping from paper the marks of black lead pencil. It must, therefore, be of singular use to those who practice drawing. It is sold by Mr. Nairne, mathematical instrument maker, opposite the Royal Exchange. He sells a cubic piece of about $\frac{1}{2}$ inch for 3 shillings, and he says it will last for several years." The trade in Para rubber has altered since that date. In 1836-7, 141,735 lbs. of good quality rubber was exported from Para; in 1855-6, the quantity was 3,477,445 lbs. There are three or four forms in which we receive Para caoutchouc in this country:—1st, flat pouches, called biscuit; 2nd, the well-known bottles; 3rd, Negrohead; and 4th, scrap. The "biscuit" consists of all the fine rubber, carefully prepared. It is made in the same manner as bottles—by successive dipping—thus showing a beautifully even, laminated appearance. The necks are very narrow, thus necessitating cutting the sides to let the mould out. The "Negrohead" consists of all the "scrap" left after the preparation of the fine, rolled into very large balls or blocks, sometimes about twelve inches in

diameter. These offer an excellent opportunity for adulteration, which the Indians are not slow to avail themselves of. But of this I shall have more to say further on.

The entire imports of Para india-rubber into England, for 1867, was 4,750 tons. The price of Para rubber, as in the case of all other rubbers, varies according to supply and demand. The lowest price ever paid is said to have been 7½d. per lb. During 1866 the price ranged between 1s. 7½d. and 3s. 1d. The present price for fine rubber is about 3s. 3d. per lb.

Maranhão.—Occasionally parcels are received from this Brazilian province. It has much the appearance of that of Para, and in all probability it is produced by the same trees. At least species of *Hevea* are found there in quantity.

Pernambuco.—This rubber is most probably obtained from *Hancornia speciosa*, Gomes, a tree well known to Brazilians under the name of "mangava," or "mangaba," the fruit being held in very high estimation. This tree, according to Chev. de Clausen,* "grows on the high plateaux of South America, between the 10th and 20th degrees of south latitude, at a height of from 3,000 to 5,000 feet above the level of the sea." Dr. Gardner describes the tree as reaching to the size of an ordinary apple-tree, though its small leaves and drooping branches give it more the appearance of the weeping birch. The fruit is yellow, a little streaked with red on one side, about the size of an Orleans plum, and of delicious flavour. When in season it is brought to Pernambuco for sale.

In the Catalogue of the Brazilian Products, at the Paris Exposition of 1867†, the following notice occurs:—[Translation.] "The milk of the tree called 'mangabeira' (*Hancornia speciosa*), gives an extremely fine caoutchouc, but whether, in consequence of a fear of compromising the life or duration of the tree whose fruit is much sought after, or because the tree is not abundant, the caoutchouc is met with only as a rarity."

This rubber is of a very fine quality, being in value very near that of Para. I am indebted to Messrs. J. H. Rayner, of Liverpool, for my specimen of this rubber. It is hard, very clean, of an even, yellowish-white colour, and on the outside of a black colour. At present we may not expect any large quantities of this rubber, the tree being valued for its delicious fruit more than for its caoutchouc, and therefore, on this account, the natives are rather chary in collecting rubber from it lest its fruiting should thereby be injured. The wood is compact, hard, and durable, being used for cabinet-work, blocks, wheels, &c.

Hancornia speciosa is common also in the province of Sergipe, the milk being employed in medicine.

Ceará.—This rubber consists of reddish brown, string-like pieces rolled up into balls or blocks, and known commercially as "Ceará scrap." With regard to this rubber, Mr. Henry Lee Norris, the manager of the North British Rubber Company, thus writes to me:—"Ceará rubber is collected by puncturing the tree in the beginning of the dry season; the rubber heals the wound by exuding in the shape of tears, which, at the end of the dry season, are picked off from the trunk of the tree. The quality is good, but much mixed with bark, etc."

FRENCH GUIANA.

India-rubber exists in large quantities in French Guiana. According to the Catalogue des Produits des Colonies Françaises, &c., p. 33, it is produced by *Hevea Guyanensis*, Aub. The passage is as follows:—[Translation]. "*Hevea Guyanensis* is abundant in Guiana, though not in large quantities, except in the contested part between Brazil and the Oyapock, where it is collected by the Indians and transported to Para."

* L'Empire du Brésil à L'Exposition Universelle de 1867, à Paris. Rio Janeiro, 1867, p. 61

* British Association Report, 1855, p. 103.

† L'Empire du Brésil, etc., p. 72.

BRITISH GUIANA.

As far back as 1840, Robert Schomburgk says*—"That valuable substance, caoutchouc, is yielded by different trees and plants." In the catalogue of the British Guiana products at the Exhibition of 1862, there is the following:—"Caoutchouc. Contributed by J. Outridge. From River Demerary, near the Falls. Taken from the india-rubber tree by tapping, and formed into balls by the Indians, who climb the tree, and, as the gum exudes, rub it on their bodies till it assumes a sufficient consistency to be formed into balls." In the catalogue of the British Guiana products at the Paris Exposition of 1867, india-rubber is mentioned, though its botanical source is stated to be undetermined:—"A specimen of *Hevea pauciflora*, Spruce, yielding a copious milky juice, was collected in this colony by Schomburgk,† as also a species of *Tabernaemontana*, noted by him as having the same property.

In January, 1866, I obtained a specimen of Demerara rubber, in the shape of small round bottles and balls. They have much the appearance of Para gutty bottles. My specimens are identical with specimens Mr. Silver received from Sir W. H. Holmes.

VENEZUELA.

From Venezuela, I believe, large quantities of india-rubber can be obtained. I, however, am expecting information relative to this state from my excellent friend Dr. Ernst, of Caracas. From Dr. Ernst, who is a good botanist, and the Natural History Society of Caracas, of which he is president, Venezuela will doubtless receive much benefit in the way of developing her resources.

Having thus dealt with the *Hevea* group of rubbers, we now pass to a second well-marked group, viz., those produced by the *Castilloa elastica*, Cerv. To this plant we are indebted for nearly all our india-rubber obtained from Central America, New Granada, Ecuador, and the West Indies. It is found in Mexico, all the Central American republics (viz., Guatemala, Salvador, Honduras, Nicaragua, and Costa Rica), the Isthmus of Panama, West Coast of America down to Guayaquil and the slopes of the Chimborazo; it also grows in Cuba; and, if the early account of Columbus may be relied upon, in Hayti. The Spanish name of this tree is "Arbol de Ulé," or Ulé-tree, an exact translation of the Aztec "Ulequahuitl." Of this group, those kinds which appear in commerce are known as—1. West India; 2. Carthagena; 3. Nicaragua; 4. Honduras; 5. Guayaquil; 6. Guatemala. These I shall treat under their respective countries.

NEW GRENADA.

New Grenadian rubber, or Carthagena as it is called, is imported in the form of sheets of about $\frac{3}{4}$ of an inch in thickness, having a peculiar "chewed" appearance, resulting most probably from the pressure used in cleansing and drying the rubber. This rubber is now used, on account of its purity, for many purposes for which Para alone was formerly used. It is black in colour, tough, and occasionally "tarry" in appearance. Its price is about 1s. 2d. per lb. As to this rubber, if analogy of character be any criterion, I should say that, in all probability, it is derived from *Castilloa elastica*. However, Dr. Spruce says, "I have often been told of a pinnate-leaved tree, yielding caoutchouc, which I could never fall in with. I am, therefore, unable to guess even at the family to which it belongs; but there is said to be such a one about Serpa, on the Amazon, and the same (or a cognate species) in some inland region of New Granada or Venezuela, whence it finds its way to Carthagena."

ECUADOR.

The rubber of Ecuador is exported from Guayaquil,

and known under this name. It is imported in the form of large black flakes or lumps. When cut, it is sometimes whitish, but in the lower kinds very porous, the pores being filled with a black liquid, which stains the hands and knife, leaving a disagreeable odour behind. Sometimes, by the mere pressure of the hand, a large quantity will exude. Its price is from 1s. to 1s. 2d. per lb.

On a specimen of *Castilloa elastica*, Cerv, collected in Ecuador by Dr. Spruce in December, 1860, are the words, "The India-rubber Tree of Guayaquil." The exports from Ecuador in 1861 were 811 quintals; in 1862, 300; 1863, 2,227; 1864, 1,889; 1865, 3,788; and in 1866, 5,708 quintals.

PERU.

According to Mr. Clements Markham, india-rubber trees are plentiful in Peru. The *Castilloa elastica* is found here. In the Kew Herbarium there is a specimen of *Hevea Peruviana*, collected in Peru, and said to yield gum elastic.

PANAMA.

The *Castilloa elastica* grows here in large quantities. On a specimen in the Kew Herbarium, collected by Mr. Sutton Hayes, the following notes occur:—

"Leaves of the Ulé-tree, collected in Sonsonate, in San Salvador, May 15th, 1860. I also got ripe fruit from the same place at the same time. Sometimes the leaves are much larger than these. I have collected the leaves of this same tree on the Isthmus of Panama, at a small native town on the Rio Gatun, called Corriente de Lechi, about six miles from the railroad. At this place I saw the natives making the caoutchouc; but the tree is most abundant on the Rio Trinidad, where there is an establishment producing very fine and pure caoutchouc from it. The caoutchouc furnished by this tree, when well cleaned and prepared, is very nearly equal to that of Para, some fine lots of it having been sold in New York for nearly as high a price as that from Brazil; but the finest specimen of the caoutchouc I ever saw were made from the milk of this same tree at Chinandega, in Nicaragua. Caoutchouc, within the last year, has been shipped quite largely from all the Central American ports at which the Panama Railroad Company's steamers touch."

COSTA-RICA.

There are reported to be whole forests of *Castilloa elastica* in Costa Rica. At the request of Mr. Silver, I drew up instructions for the collection and preparation of trial samples for a resident, who is very anxious to develop this branch of commerce.

NICARAGUA.

Recently very good rubber has been shipped from Greytown, Nicaragua. About 100 tons have been received in England during the last year, selling for about 1s. 3d. per lb. It is in the form of thin sheets and well prepared. The following account, written by M. Diezmann, of Greytown, and forwarded by Mr. John Collinson, C.E., to Dr. Seemann, will be of interest:—"Ule' (or 'Tassa' of the Mosquito Indians) is an important article of export from Nicaragua, and San Juan del Norte, or Greytown, is the principal port whence it is shipped. Having for many years dealt in it, and having never seen a correct account of the manner in which it is collected and manufactured, I shall offer a few remarks on the subject. Expeditions for collecting Ule, or Nicaraguan india-rubber, are organised by a number of men clubbing together, and applying to one of the india-rubber dealers, who furnishes them with the necessary outfit, including provisions, blankets, machetes, axes, pans, pails, baskets, &c. They bind themselves before the local authorities to work a certain time for the dealer, and deliver the produce of their work to him. This formality gone through, the men—or Uleros, as they are now called—generally have a series of amusements, dancing, drinking, and

* Description of British Guiana, London, 1840.

† Hooker's Jour. Bot., vol. iii., 1841, p. 246.

gambling, until the dealer intimates to them that their departure ought not to be delayed any longer. All the necessary things are now embarked, and under the blowing of conch-shells and shouts of friends, the canoe shoves off. Often the poor fellows have to travel a fortnight before they arrive at their destination,—passing rocks and rapids, and being frequently compelled to unload the canoe and drag it over them by sheer main force. At last, when arrived at their goal, their first efforts are directed towards building a hut to live in, beds being made of sticks, and on stages a few feet above the ground. A workshop is also built, if possible, as close as practicable to a river, a great quantity of water being required in the manufacture of the rubber. After an early breakfast, the men go to work, each man carrying a machete, a tin-can holding five gallons, and one or two wooden pails.

"As soon as the Ulero has selected his tree, he clears the ground about it of underwood and the stem of vines and epiphytical plants, and makes a ladder by tying pieces of cane two feet long to some tough vines about eighteen inches in diameter. All this preliminary work gone through, the Ulero cuts diagonal channels in the bark of the tree, first from his right side, then from his left, so that both meet in the middle. At the bottom of the lowest channel, an iron spout, about four inches long and two inches broad, is driven, underneath which a pail is put. Now the Ulero ascends his ladder, cutting channels right and left, every two feet apart. By the time he has done this he has to hurry down, his pail being now quite full, and it has to be emptied into the larger vessels, in which it is carried to the workshop. A tree 4 feet in diameter, and 20 to 30 feet to the first branches, will yield 20 gallons of milk, each gallon producing 2 lbs., and if rich 2 lbs. 2 oz., of good dried rubber. A good working man is able to get from 10 to 25 gallons of milk a day. In the evening the milk is pressed through a wire sieve, so that all the impurities are excluded before it is put into the barrels. When the barrels are full, the real manufacture of the rubber commences. This is generally intrusted to the most skilful of the party. The best manner of converting the milk into rubber is by mixing with it the juice of a certain vine, termed 'Achuca' by the natives, which has the singular property of coagulating it within the space of five minutes. This vine generally abounds in the woods, and has fine large white flowers. Bundles of it are collected, and each stick well beaten with a piece of wood, and soaked in water, which is strained through a piece of cloth, and about a pint of it is well mixed with every gallon of the milk. This is done in a large tin pan, in which it coagulates quickly, forming a soft mass floating in a brown fluid, and smelling like fresh cheese. This mass is slightly pressed by hand, placed on a board, and then rolled out with a piece of heavy wood. I have used with advantage an iron roller, 150 lbs. in weight, for this purpose. By this operation a great quantity of dark brown water is squeezed out, and the rubber, which has now assumed its elasticity, is in flat round pieces, of $\frac{1}{4}$ to $\frac{1}{2}$ -inch thick, by 20 inches in diameter, and perfectly white. The weight of one of these pieces ('tortillas,' the men call them) is about 7 lbs. The tortillas are hung up in a shed on poles to dry, which in fair weather takes about a fortnight; the rubber assumes then its dark colour, and weighs 2 lbs. a piece. If the vine is not to be had in the neighbourhood, two-third parts of water are mixed with one-third of milk in a barrel, and this has to remain undisturbed for twelve hours; after this time the water is slowly discharged, and the residue—a dark cream—is put in vats made in the ground, and left to dry. The drying process takes from twelve to fourteen days

SALVADOR.

India-rubber is found in Salvador, and is collected for

* Dr. Seemann, in his recent travels in Nicaragua, found the plant to be *Calonyction speciosum*.

exportation. I have never seen any specimens of it. Mr. Sutton Hayes gathered the *Castilloa elastica* here in 1860.

WEST INDIA.

Under this name the best kind of Central American rubber is known. The finest is received in the form of blocks, consisting of thin sheets, and of great purity. The lower kind is known as "scrap," consisting of all the refuse pieces left in the preparation of the best; its price is about 1s. 6d. per lb. This rubber, as far as I can at present ascertain, is not the produce of any of the West India Islands, being merely called "West India" from the fact that the mail steamer calls at St. Thomas, on the way home. Does Belize or Yucatan contribute anything towards it?

HONDURAS.

This rubber is rarely met with in commerce. The exterior is of a dark colour, the interior of a greenish grey. In texture, it is firm, and not porous. The price is about 1s. 6d. per lb. This rubber may be the produce of *Castilloa elastica*, but of this I am not certain; its different appearance from other accredited products of the same plant may be the result of chemical treatment.

GUATEMALA.

This rubber is the lowest kind of American rubber. It is in large blocks, consisting of thin sheets pressed together. From between these sheets, when fresh, a black, thick, resinous fluid exudes; after a time the water evaporates, and leaves a hard resinous substance behind, unaffected by hot water or steam. The rubber itself is jet black in colour, though, when purified from its resinous contents, I believe of a whitish colour. On a specimen collected in Guatemala, in 1861, by Mr. Sutton Hayes, he says, "All the caoutchouc of Central America is derived from this tree, and that from Carthage and Guayaquil probably from the same source." Its price is about 1s. 2d. per lb.

MEXICO.

India-rubber can be obtained in Mexico. In an interesting work, on the "Materia Medica of Mexico,"* there is the following notice:—(Translation).—"Ulé.—*Castilloa elastica*, Cervantes, is a tree which grows in the warm coast regions of the Republic, and particularly in that of the Rumbo of Vera Cruz. It also occurs in the hacienda of S. José del Corral at Cordova. Its resin, recently extracted, is of a colour like milk, in which state it serves for economical purposes, and also for making elastic instruments used in surgery. They also prepare with this liquid resin sheets of silk, linen, or cotton, which are made use of in medicine to produce perspiration, and disperse tumours."

Heller† also makes mention of the rubber obtained from the ulé in Mexico, and says that waterproof boots and shoes are manufactured in great quantity, especially in Tabasco.

Having thus far dealt with the different kinds of caoutchouc afforded us in America, we next pass to the consideration of

II.—ASIATIC KINDS OF INDIA-RUBBER.

The interest which the discovery in South America of a substance with such remarkable properties, stimulated search being made for it in other parts of the globe. This led to its being found in the East Indies and the Archipelago. The credit of its first discovery is due to James Howison, a surgeon, in Prince of Wales Island. His paper is entitled "Some Account of the Elastic Gum Vine of Prince of Wales Island, and of Experiments Made on the Milky Juice which it Produces, with Hints

* "Ensayo Para la Materia Medica Mexicana, Puebla, 1832." In the library of Mr. Daniel Hanbury, to whom I am indebted for the translation.

† "Reisen in Mexiko, 1845-8. Leipzig, 1851. Von Bartholomaeus Heller.

respecting the Useful Purposes to which it may be applied."* In this paper he says that the tree has branches, sometimes 200 paces long. The Malays taste the juice to find which is the elastic variety. The usual manner of drawing off the milk was by tapping, a quart in two days being considered full employment for one person. But the quickest way was to cut up the "vine" in lengths of about two feet. The oldest vines produced the best caoutchouc, the juice of which, being of the consistency of thick cream, yielded two-thirds of caoutchouc by weight.

In his experiments he made wax moulds of articles such as gloves, boots, &c., and dipped them in the liquid caoutchouc. He also made himself a complete suit of waterproof garments, spreading the liquid caoutchouc on the cloth with a ruler, and hanging them out in the air, the mere exposure rendering them dry immediately. Roxburgh, being in India at the time, directed his attention to the subject, named Howison's plant *Urceola elastica*, and described it as a native of the islands of Penang and Sumatra, &c., and the Malayan countries; stem woody, climbing over trees, &c., to a great extent; young shoots twining, and a little hairy; bark of the old woody parts thick, dark-coloured, and considerably uneven, a little scabrous, the wood being white, light, and porous.

The next discovery was in 1810, by Dr. Roxburgh himself; this, however, we shall notice under the head of Assam rubber. Asiatic kinds of caoutchouc may be noticed under two groups, viz., those of the Malayan Archipelago, and those of India, the former of which we shall treat of first.

MALAYAN ARCHIPELAGO.

Singapore.—From this island the greater part of the rubber of the Malayan Archipelago is exported. Singapore is an apt illustration of the difficulties one has to contend with in determining the geographical source of vegetable products. Here is an island, no larger than our Isle of Wight, exporting enormous quantities of raw goods, and the question naturally arises, Are these home products? Singapore, from her highly favourable position, not only forms a vast entrepôt for the surrounding states, but also for Calcutta, Java, Siam, Burmah, China, &c. The value of its imports in 1863 amounted to £6,461,720. With regard to our immediate subject of caoutchouc, Mr. Thomas Hancock † gives the following instructive table:—

Imports at Singapore of caoutchouc for the years 1849-50 to 1854-5.

	lbs.
From Java	358,736
„ Sumatra.....	763,280
„ China.....	1,680
„ Manilla	14,896
„ Borneo	3,024
„ Malay Peninsula	448
„ Penang and Malacca	253,668
„ Elsewhere	130,256

During the period from 1849-55, only 723,968 lbs. were native produce, and since that period nearly all the trees have been destroyed. In a table given by Cameron, ‡ it is stated that £14,110 was the value of the india-rubber exported to Great Britain, in 1863, from Singapore; and he adds that it is not a native product, but that it is received from neighbouring states and stored up in the godowns or warehouses for re-exportation. The rubber known as Singapore has a very bright red, mottled appearance, and is very hard in texture, especially when old. It is received in baskets, weighing about three cwt., made of split rattans, covered with a jute gunny bag.

Borneo.—This kind of rubber is received either from Sarawak or *via* Singapore. It made its first appearance in our markets in 1864, under the name of "gutta

susu" (Malay, *milk-gum*). This rubber in appearance is unlike all the other Asiatic kinds, being white, soft, porous or spongy, and very wet. In a new specimen it is no difficult matter to press out a large quantity of water having a saline taste. When old it changes colour to a dull pink, or brown, the cut portions being frequently encrusted with salt after the evaporation of the water. It has rather an unpleasant smell. This rubber is collected by the natives and sold to the Europeans. The published accounts of this kind of rubber are very interesting. Mr. Low* has the following:—

"Caoutchouc might be obtained in quantities in Borneo, as well as in many other of the islands, and on the peninsula; it is the produce of a climbing plant, of the genus *Urceola*, which grows to the size of a man's body. The bark, which is soft and thick, with a very rough appearance on being cut, emits the sap in the greatest abundance, and without destroying the tree. Very large quantities might be obtained from a single trunk.

There are three kinds in Borneo, called by the generic name "Jintiwan" by the natives. Two are common in Sarawak, viz., "J. susu, or milky jintiwan, and the J. bulat, or round-fruited jintiwan. They equally produce the caoutchouc. The natives of Borneo use it to cover sticks, with which they beat their gongs and other musical instruments. The fruit, which is large, and of a fine apricot colour, contains ten to twelve seeds, enveloped in one of the most grateful fruits of the country to the European palate."

In the *Singapore Local Reporter*, of August 7th, 1853, † the following appeared:—"This gum, the produce of creepers known in that part of Borneo under the names of Serapit, Petabo, and Menungan, is nothing else than the watery milk-sap of these creepers, which, by a simple process, in the addition of a little salt water, takes the consistency and all the peculiarities of real india-rubber, being at first snow-white, but by exposure to the air changing slowly to a dirty yellow, and afterwards brown colour. The serapit produces the most common, the petabo the best, and the menungan the greatest quantity of sap. The gum obtained in this way contains water enclosed in small cavities, which we believe to have been formed by the celerity with which the sap hardens, preventing the salt water, and perhaps the watery part of the sap, from finding an issue. . . . During our peregrinations in the jungle of Singapore, we have met with the identical creeper, called menungan in Borneo, but which the Malays here call ngerit, or ngret, and on inquiry have heard from the native wood-cutters that the same is found in great quantities in Johore and the neighbouring islands. . . . The process for obtaining the sap in use by the Badjows and the Muruts is very simple, but we should like to see an attempt made to obtain it in a manner less destructive to the plant. These people cut the creeper into small pieces, of one foot to eighteen inches in length, allow the sap to flow into their jars or buckets, and put one end of the piece over a slow fire, whenever the sap does not flow quick enough. They, therefore, destroy the plant in order to obtain the juice. The creeper could also form a new branch of agriculture, for it grows fast enough to procure a supply of sap in less than three years, and after planting requires no further cultivation."

Mr. James Motley, in a letter dated Singapore, March, 1854 (*Kew Journ. Bot.*, vol. v., p. 285), thus describes the plant:—"A very abundant creeper was the india-rubber producing *Urceola*; its fruit is about the size of an orange, and colour of an apricot, the thick outer skin full of milky juice, while within are about eight or ten seeds enveloped in a tawny pulp, tasting like well-battered medlars. The natives use the juice only as birdlime." Again, while at Sumatra, he writes

* Asiatic Researches," vol. v. Calcutta, 1798.

† India-rubber Manufacture in England (London, 1857), p. 168.

‡ Our Tropical Possessions in Malayan India (London, 1865).

* Sarawak; its Inhabitants and Productions, by Hugh Low, London, 1848, p. 51.

† As quoted in Hooker's *Journal of Botany*, vol. v., page 157.

(*New Journ. Bot.*, p. 167):—"The plant yielding the best india-rubber, I think an *Urceola*, is common here; it is a large climber, as thick as a man's leg, with a dark rugged bark; it is called 'Jintawan' by the Malays, but this includes three species—menungan, serapit, and the petabo. The fruit of the serapit is the best, but all are much valued by the Malays, the pulp surrounding the seeds being very sweet, with a pleasant acid and a fine vinous flavour. To collect the sap, the stem is usually cut into billets a few feet long, from both ends of which the milky juice flows abundantly, and the plant soon springs up again. The gum is not collected among these islands, though the locality, always within the reach of the sea, is highly favourable, the only preparation required being to mix salt-water with the sap, the solid parts of which instantly coalesce."

All these quotations given refer to one and the same plant, viz., *Urceola elastica*, Roxb., and the descriptions given agree well with the known characteristics of the Borneo rubber of commerce.

When this rubber first made its appearance, I took considerable pains to determine its botanical origin. Dr. Roxburgh, in his description (before referred to) of Howison's plant, speaking of a ball of the india-rubber before him, says:—"Its colour on the outside is that of American caoutchouc; when fresh cut into, a light-brown colour, till the action of the air darkens it; throughout there are numerous small cells, filled with a portion of light-brown watery liquid."

These accounts agree as to the varieties, mode of collection, and treatment with salt-water. As to colour—an important consideration—Roxburgh had not the opportunity of examining a recent specimen; and it is well known how soon Borneo rubber, especially the more porous species, will change colour. Mention, too, is also made of its white colour when fresh, and of its alteration when exposed to the atmosphere. Both Roxburgh and the *Singapore Reporter* refer to the "cellular" formation in this rubber. There is, moreover, no other description of Asiatic rubber which would at all answer to the well-marked characteristics of the caoutchouc of *Urceola elastica*. On a specimen of this plant in the herbarium of the British Museum, collected in Sumatra by Campbell, there is this note—"White Caoutchouc. The *Urceola elastica*, Roxb., has a wide distribution, growing in the Malayan Archipelago, Sumatra, island of Penang, &c."

Java.—The india-rubber known under this name has a dark glossy appearance, with streaks of reddish and white colour, giving it a mottled look. For a considerable time I was unable to obtain any information respecting the botanical source of this india-rubber. It was, therefore, with pleasure I availed myself of a visit, paid me last month, by Dr. J. E. de Vrij, who was connected with the Java Cinchona Plantations, to ask his opinion. He stated that it was the produce of *Ficus elastica*, and subsequently kindly furnished me with the following interesting account:—"In Java, india-rubber is extracted from *Ficus elastica*. The native name of this tree is "pohon karet," or "kohlehet." When the natives find this tree they make incisions in the stem, from which incisions there immediately flows a milky juice, which very soon coagulates, and becomes of a reddish colour. They collect these coagulated masses and combine them in the form of a thick rope. In this form it is sold in the markets. The natives often use these ropes for illuminating purposes when they are in search of the famous edible birds'-nests to be found in the caverns. That the india-rubber of Java is really obtained from *Ficus elastica* I am quite sure, as I have collected it with my own hands from that tree. The amount collected is, however, not very great. More important is the quantity of india-rubber collected in Sumatra. The native name of the tree from which it is collected there is "Getah-katjai," but the scientific name is unknown to me." [Dated The Hague, Nov. 27, 1869.]

Miquel (*Fl. Ind. Bat.* vol. iii.,) mentions *Willughbeia edulis* and *Vahea gummifera*.

The remarks of Dr. de Vrij, with regard to Sumatran rubber, prompt me to ask what becomes of this kind of rubber. *Urceola elastica*, as we have seen, grows in Sumatra. Is any of the rubber of this plant which we receive from Singapore produced in Sumatra, and thence taken to Singapore?

Penang.—This rubber is of a dark colour. Is it the produce of *Cynanchum ovalifolium*, Wight, which is stated by Dr. Wallich as yielding an excellent caoutchouc, and was found by him in Penang? It is a smooth twining plant (*Lindl. Fl. Med.*, p. 542.)

Siam.—This india-rubber is of a white, or pinky, or liver-like appearance; it is rare in our markets. I do not know by what plant it is produced.

INDIA.

Assam india-rubber is the only kind we obtain from India. It is the produce of *Ficus elastica*, Roxb. As we have incidentally mentioned, Roxburgh made the second discovery of a tree yielding india-rubber. He named the tree *Ficus elastica*, and gave the history of its discovery. "Towards the close of 1810," he says, "Mr. Matthew Richard Smith, of Silhet, sent me a vessel, there called a turong, filled with honey, in the very state in which it had been brought from the Pundua or Juntipoor mountains, north of Silhet. The vessel was a rather common or rather coarse basket, in the shape of a four-cornered, wide-mouthed bottle, made of split rattans, several species of which grow in abundance amongst the above-mentioned mountains, and contained about two gallons. Mr. Smith observed that the inside of the vessel was smeared over with the juice of a tree which grows on the mountains. I was, therefore, more anxious to examine the nature of this lining than the quality of the honey. The turong was, therefore, emptied and washed out, when, to my gratification, I found it very perfectly lined with a thin coat of caoutchouc." (*Roxb. Flor. Ind.* iii. 543.)

Roxburgh also found that older trees seemed to yield a richer juice, which, when exposed to the air, separated spontaneously into an elastic substance or caoutchouc, and a fetid whey-coloured liquid. It is collected by making incisions through the bark to the wood. About 50 ounces of the pure milk taken from the trees in August yielded 15½ ounces of clean washed caoutchouc. After one operation, the tree requires a fortnight's rest, when it may be repeated. During the cool season, from October till March, the juice is more scanty than in the warm weather, from March to October, but richer. Assam rubber is shipped from Calcutta in baskets made of split rattans, and weighing about 3 cwt. each. These are generally covered with a jute gunny bag. This india-rubber has a peculiar mottled appearance, of a bright pinky colour, and very glossy. The baskets consist of either a great number of small "balls" pressed together, or a large irregular mass called "slab." The former is not so much liked, as it offers greater facilities for adulteration than the latter. It is curious to see this and other kinds of hard india-rubber sampled at the London wharves, &c., as, owing to its resistance, it will only allow of being cut with a chopper or knife constantly kept wet with a stream of water. It sometimes takes three or four men some considerable time to cut out a slab about twelve or fourteen inches long. According to Royle, any quantity of rubber can be obtained from India. One great fault, however, clings tenaciously, not only to this, but to all East Indian varieties—that is, its impurities. There is no reason why the caoutchouc of India should not be as pure as fine Para, if proper care were taken. In 1836, while Para rubber was selling at 2s. 6d. to 3s. per lb., East India was only selling at 2d. ! and, although there is more care taken now, yet there is great room for improvement. How ignorance may retard the development of a country's resources! In 1828, a zealous

collector sent a parcel of rubber from Assam to a large agency in Calcutta, but the consignment, at a loss what to do with it, sent back the sample with the following reply, much to the disappointment of the collector:—"The article being unknown in the Calcutta market, we are sorry we can give you no idea of its value." Samples of it are said to have been in England as early as 1828, and first used in 1832.

Roxburgh mentions several other plants producing caoutchouc; among others is the *Willughbeia edulis*, Roxb., found in the forests of Chittagong and Silhet, where it is called Luti-am. It is a large climbing plant, and when wounded discharges copiously a very pure viscid juice, which soon, by exposure to the air, changes into an indifferent caoutchouc. (Roxb. Fl. Ind., vol. ii., p. 57.)

Large quantities of india-rubber are said to exist in China; I have not heard of any direct shipments. If we receive it at all, it is *via* Singapore.

III.—AFRICAN KINDS OF INDIA-RUBBER.

Everything connected with Africa and its intrepid explorers fails not to create attention, and the question of the production of caoutchouc in this vast country is one of great interest. I shall first direct your attention to the East Coast and the adjacent islands, beginning with

MADAGASCAR.

This description of india-rubber, which is rather rare in this country, and generally passing, I believe, under the name of Mauritius-rubber, is used largely in France.

Dr. C. Meller, in his account of an expedition to Madagascar (read before the Linnean Society, December, 1862), says of the natives:—"To procure india-rubber they are less careful, merely making incisions, and allowing the sap to flow into a hole at the root of a tree. They procure their india-rubber from a trailing and climbing plant, whose order I am unacquainted with. It has thick cordate leaves, pear-shaped and sized fruit; the native name is 'Vaughina.' The *Picus elastica* is found along the seaboard route, and a *Theophrasta*; but I am not aware that the Malagasy have recourse to them." Miquel (Flor. Ind. Bat., vol. iii.) mentions Madagascar as one of the habitats of *Willughbeia edulis*, Roxb.

Mons. F. Coignet, in an account of an excursion on the north-east coast of Madagascar,* gives some interesting notes on the india-rubber of this island, of which I will give a brief abstract. He says that there are two descriptions of caoutchouc, one obtained from three species of a climbing plant, which, I believe, will prove to be species of *Vahea*, and a shrub which often attains a height of from five to six metres, and having a smooth bark. Of these climbers, one yields a much superior product, though the natives do not keep it separate from the other two. The milk is collected by incision and coagulation, brought about in two ways; first, by the addition of salt water, and, second, by the application of artificial heat.

A short time since, I received the specimen exhibited from Messrs. E. Cronan, of Nantes, through the interest of Dr. Edward Bureau, of Paris, who, I am glad to say, has promised to institute inquiries for me respecting this description of rubber.

India-rubber producing plants occur also in Nossi Bé, on the north-west coast, and in St. Marie, on the east coast of Madagascar.

COMORO ISLANDS.

Johanna.—Dr. Meller collected a species of *Vahea* here, and on his specimen he remarks that it is identical with the "Vaughinia" or "Vaughina" of Madagascar.

* Bulletin de la Société de Géographie. Septembre, 1867, p. 289. For a M.S. copy of this account I am indebted to my good friend M. Augustin Delondre, of Paris, as also together with M. le Dr. J. L. Soubeiran, for several French pamphlets, from which I have quoted in the present paper.

Mohilla.—Species of *Vahea* were collected here by Dr. Meller. The same plants grow also in the Isle of Mazotte, and in the Isle of France.

EASTERN AFRICA.

Zanzibar.—In the Kew Museum there is an interesting specimen of india-rubber, collected by Dr. Kirk, in Zanzibar, from a species of *Landolphia*. This specimen is of good quality, having a semi-translucent appearance, and of a reddish-pink colour, looking much like bright Assam.

Mozambique.—Recently a small parcel of india-rubber, of good quality, has been received from this district. According to MM. Soubeiran and Delondre,* there is a great abundance of caoutchouc obtainable in the Inhambane district, large quantities of which are exported.

Zambesi.—The explorations of Dr. Livingstone in this district, thanks to the Drs. Kirk and Stewart, have been the means of increasing our knowledge on the subject before us. India-rubber-yielding plants have been found near Lakes Nyassa and Shirwa. In the Kew Museum there are two specimens collected by Dr. Kirk, one on the River Shire, supposed to be produced by a species of *Curpodinus*, of a dark Java description, and the other, of a Singapore character, from a species of *Carissa*. On the table is a specimen of caoutchouc, which was collected by the Rev. Dr. Stewart, now of Natal, up the Zambesi.

SOUTHERN AFRICA.

Cape Colony.—About twelve months ago, the Rev. J. C. Brown, LL.D., formerly the government botanist at the Cape, wrote me concerning the utilisation of the sap of different species of *Euphorbia*, and kindly forwarded such of his official reports as contained notices on the subject.

In his letter, he says:—"We have, at the Cape of Good Hope, extensive plots of different species of cactus-like *Euphorbias*, cumbering the ground and useless. The milk sap of all the species is said to have been made into india-rubber. The milk sap of one species is made by boys, for amusement, into a substance like masticated india-rubber. The milk saps of other species have been made into ebonite and vulcanite, or substances closely resembling them. The same, and others again, have been used in making waterproof buckets, and coatings of the same have been successfully used in insulating wires for electric telegraphs. But every attempt to get liquid, desiccated or coagulated, milk sap brought to this country in a state to be useful in india-rubber manufactures, has failed." [Dated Haddington, October, 1868.]

Dr. Brown has given great attention to the subject, and, at his suggestion, I drew up instructions for the collection and preparation of such samples as should allow of an opinion being formed on the subject. From what little I know of the products of other species of the same genus, *E. Cattimandoo*, &c., I should suspect that the so-called india-rubber has more the character of some of the brittle kinds of gutta-percha.

WESTERN AFRICA.

West Coast.—The caoutchouc known in commerce as African is obtained from the West Coast. The first importation took place in 1856. We receive it in the form of flakes, round balls, and "tongues." The last are about four inches long, angular from adpression, and a little thicker than your thumb. It has a most offensive odour. I am, as you may admit, rather fond of india-rubber, but the less I have to handle this kind the better I like it, my liking for it certainly not improving on better acquaintance. It is of a yellowish white colour when new, very adhesive, and very slightly elastic; when old, it turns black, and loses much of its fetid

* "Produits Végétaux du Portugal" (Paris, 1867), p. 22.

odour. It is the poorest of our commercial kinds, its price ranging from about 8d. to 1s. per lb. The lowest price it has been sold at is stated to be 4½d. per lb. The plant yielding this india-rubber seems to be common to the whole of west tropical Africa; large forests of it are said to exist in Guinea, Gaboon, Congo, Angola, &c. Up to the present time I have been unable to ascertain the botanical source of this description of caoutchouc.

In the Kew Museum there is a piece of wood with pieces of rubber exuded from it, brought from the West Coast by Dr. Africanus Horton. This rubber is undoubtedly identical with our commercial kind, but, unfortunately, the fragment of the plant brought home, possessing neither flowers nor fruit, did not admit of identification. A short time since, I received a letter from Dr. Horton, dated Cape Coast Castle, August, 1869, in which he says:—"The plant of my specimen was discovered far in the interior, about 200 miles from here, and the means of communication, now that the interior is in a state of commotion, is by no means easy. I have, therefore, but a poor chance at present of getting the flower of the plant. However, I shall make an effort, and, should I succeed, I shall write you on the subject." It may prove a species of *Landolphia*.

Gaboon.—According to the catalogue of the French colonies at the Exhibition, 1862,* caoutchouc is obtained in great quantities in Gaboon, from two climbing plants, which I suppose are species of *Landolphia*. It is brought down to the coast by the natives in the form of small balls and flakes. It is described as being very viscous, and of a disagreeable odour.

Congo.—From the River Congo, part of our commercial "West Coast" caoutchouc is shipped.

Angola.—Thanks to the great liberality and warm support accorded by the Portuguese Government, important botanical investigations have been made in Angola by Dr. Friedrich Welwitsch. This gentleman has kindly given me the following account for publication:—

"The very considerable number of milk-yielding trees and shrubs amongst the natural orders of *Moraceæ*, *Artocarpaceæ*, *Euphorbiaceæ*, and *Apocynaceæ*, to be found in the flora of tropical Africa is likely to lead one to the assertion that india-rubber yielding plants must be very plentiful, and I foster the conviction that this will really prove to be the case, although the quantity of india-rubber exported up to the present time, from tropical West Africa, and nominally from Angola, has been very insignificant, and in some cases restricted to mere samples."

"I am, however, fully convinced that this penury of exportation of so valuable an article in the European market is by no means to be attributed to the rarity of rubber-yielding plants in Angola, but results principally from the greater attention which other colonial products, such as ivory, wax, palm oil, gum copal, coffee, &c., call forth, principally on account of the easier sale and larger profit, than, under the present system, would be obtainable by the extraction of india-rubber, as the mode of collection and manipulation observed in America and Asia by the rubber-collectors seems never to have presented itself to the minds of the aborigines of tropical Africa."

"The trees and shrubs from which, according to my own observations and repeated inquiries on the spot, india-rubber is obtained from in Angola, are several large-leaved species of fig trees (*Ficus*, L.), and also several species of the Apocynaceous genus, *Landolphia*, which latter form large climbing shrubs, with stems often reaching six to eight inches in diameter, when growing undisturbed in the primeval forests, where, too, they often climb to the height of 50 to 80 feet, spreading their leafy heads like a verdant carpet amongst and along the crowns of the

larger forest trees. There is also a tree belonging to the same order, an undescribed species of *Toxicophloeæ*, growing in the less crowded woods of the highlands of inner Angola, from which a rather valuable kind of india-rubber is at times collected by the negroes, but only in small quantities, as the tree itself rarely attains to a large size, and is neither so frequent nor so rich in milky juice as are nearly all the species of *Landolphia*."

"Amongst the four or five species of *Landolphia*, which I found indigenous in various parts of the highlands of Angola, is principally the *L. owariensis*, Beauv., from which I have seen india-rubber collected by the negroes in the districts of Golungo Alto, and of Cazengo. This magnificent climbing shrub, which is by no means rare in the primeval forests of these districts, attains, under favourable circumstances, a considerable size, having a stem from four to seven inches in diameter, at the height of two to three feet from the ground. From this point it is divided into several long thin branches, which are again and again divided, climbing along the stems and larger branches of neighbouring trees, to which they fix themselves by means of most tenacious spirally-twisted tendrils formed out of the indurated flower-stalks after the ripe fruit has fallen off. The fruit is about the shape of a middle-sized orange, containing, under a hard, nearly woody, reddish-brown shell, a sweet, rather acidulous pulp, which is eaten by the natives. The fruit, and also the rubber obtained from the *Landolphia owariensis*, is called "Licongue" by the natives."

"The method which I saw employed in some districts of the highlands of Angola, by the "licongue" collectors for the extraction of caoutchouc, is a very rude and imperfect one. Having selected a tree, the collector makes a horizontal cut through the bark, and placing the palm of his hand flat on the tree below the incision, allows the milk to trickle down over the back of his hand, the mere exposure of the milk to the atmosphere causing it to coagulate, and envelope the arm in a sheet of india-rubber. When the tree has ceased to yield freely, he repeats the operation on another tree. After he had as much on his arm as he deems sufficient, beginning at his wrist, he rolls the incasing rubber back towards his elbow, the rubber being thus taken off in the form of a ring."

"From this description, it will be readily understood that, by such an imperfect method, both the quality and quantity would be considerably improved were more appropriate means used. I was, therefore, not surprised to hear that rubber prepared in such a manner did not fetch a sufficiently remunerative price in the markets in the coast towns of Angola, which circumstance had the effect, at least during my stay in Angola, of discouraging the few natives and colonists who engaged themselves in the collection and sale of this valuable product."

"With regard to the geographical distribution of these rubber-yielding plants, I may observe that *Landolphia owariensis*, first discovered by Palisot de Beauvais, in Owar and Benin, and afterwards Don, in Sierra Leone, I have encountered rather frequently in several of the highland districts of Angola, and consequently the habitat of this plant may be stated as extending from 10° lat. N. to 10° lat. S. on the tropical coasts of West Africa. The *Landolphia florida*, Benth., first found in Fernando Po, by Vogel, enjoys almost as wide a geographical range, being rather frequent in most of the primeval forests of inner Angola, where, at an elevation from 1,500 to 2,500 feet, I often met with this beautiful climber, and gratified myself with its sweet acidulous fruit, though not less so with the beauty and marvellous abundance of its large snow-white and jasmine-scented flowers."

It is to be hoped that not only the production of this substance, but also of others, will be fostered and extended in this valuable and highly interesting Portuguese colony.

Benguela.—India-rubber has been exported from Quicombo, of rather better quality than the ordinary

* Catalogue des Produits Françaises (Expos. Univ. Lond., 1862), Colonies d'Afrique, page 50.

West Coast description. Rubber is said to have been obtained in Novo Rodondo from *Ficus elastica*.*

India-rubber yielding plants have also been collected up the Niger, by Mr. Barter and Captains Speke and Grant; on the Gambia, by Dr. Vogel; and in Sierra Leone, by Mr. Don.

IV.—AUSTRALIAN KINDS OF INDIA-RUBBER.

In November, 1867, I obtained a small fragment of india-rubber collected in Australia. As well as one might judge from such a piece, it had the character of that of Assam. Dr. Ferd. von Mueller, in his essay on "Australian Vegetation" (Melbourne, 1867), p. 5, says:—"Caoutchouc might be obtained from various trees, especially the tall kinds of *Ficus*. Subsequently, on my writing to Dr. Mueller on the subject, he, with his usual courtesy, replied that "There are several species of *Ficus* in east Australia, more particularly *F. rubiginosa* and *F. macrophylla*, which yield india-rubber; but as yet we have been unable to compete with such countries as hitherto furnish caoutchouc, inasmuch as wages here is so different to what it is in India." However, I trust before long to receive specimens which will enable a more definite opinion being given.

A specimen of caoutchouc, obtained from *Ficus religiosa*, is mentioned among the products of New Caledonia, in the Exhibition of 1862.

The use of india-rubber is no longer restricted to the mere rubbing out of pencil marks, but its applications are legion, and still more numerous would they be if larger quantities, at lower prices, could be supplied. This is really the question, the practicability of which has to be solved. On the present occasion I must content myself with but a few remarks on the subject, trusting to do it more justice on a future occasion. First, as regards

I.—QUALITY.

Mode of Collection.—There are three ways in which the milk sap is collected. 1st, by simple successive incisions; 2nd, by incision assisted by binding the tree; 3rd, by cutting the tree down. The time of year at which the milk sap is collected has an effect on the quality of the product. At the time of flowering of the seringas, scarcely any milk can be obtained from the stem, whereas if the pannicles be cut, the milk starts out in large drops. If a tree be tapped too often, the milk at each successive tapping is of less strength, and becomes at last quite watery. After tapping, a period of rest from two to three years should elapse before the operation is repeated, to allow the tree to recover its strength, otherwise the milk sap will be deficient in richness and the tree injured.

Preparation.—Various methods, as we have seen, are used to bring about the separation of the particles of caoutchouc from the whey-like portion of the milk sap. They may be thus stated:—

Group. 1.—Coalescence brought about by Heat.—Examples.

- (1). Artificial heat Brazilian, &c.
- (2). Natural heat, Ceara and *Ficus* group.

Group 2.—Coalescence brought about by the addition of Various Substances.

- (3). Alum Brazilian.
- (4). Certain plants Nicaragua.
- (5). Fresh water Do.
- (6). Salt water Borneo, Madagascar.

One of the desiderata in rubber is, that it should be dry. The old mode of drying Para rubber is as follows:—After the milk is collected, the Indians gather heaps of Urucuri nuts (the fruit of *Attalea excelsa*, Mart.),† which give off a thick white smoke. They then dip their clay moulds in the milk, and holding them over the fire, repeat

the dippings till a sufficient thickness has been obtained, thus giving rise to the laminated appearance observable in Para bottle rubber. By some, this smoking process has been questioned; but Dr. Spruce, in his letter, says:—"India-rubber was certainly smoked when I was on the Amazon. The smoke used was produced by heating (toasting or roasting, not properly burning) the hard but somewhat oily nuts of the Urucuri Palm (*Attalea excelsa*, Mart.) It was very white and vaporous, and deposited no fuliginous matter whatever. A recently-made smoke-dried India-rubber shoe was of a straw-colour, or pale yellow brown; so that Martius was wrong in supposing 'Incolae fructos tostos ad fumigandum succum *Siphonia elastica* adhibent, ut resinae elasticæ nigrum colorem comparent.' The mistake, I believe, has arisen from the change of colour from the yellowish-white to brownish-black tinge, which Para rubber assumes on exposure to the atmosphere, being attributed to the action of the smoke; whereas, in all the specimens examined, I have invariably found the centre unchanged in colour, and no trace whatever of any fuliginous deposit between the laminae. Frequently I have cut off all the exterior portions of a piece of this kind of rubber, and have noticed how soon the cut edges assume the brown tinge on exposure.

I believe sulphur is also used in the preparation of Para rubber. The very hard character of the rubber can hardly be referred to simple drying; and, in the catalogue of the Brazilian products at the Paris Exposition of 1867, notice is made of the hardening effect sulphur has on rubber. The province of Para purchased of Henry Strauss his method of preparing rubber by the addition of a certain quantity of aqueous solution of alum. This operation can be performed in the houses of the collectors, thus not necessitating exposure to the boggy soil, which, in whites, always brings on fever. The Brazilian finds only one fault with this process; that is, its simplicity, the result being, all the rural population give their attention to its preparation, to the neglect of other pursuits. I may mention that, when the milk is desired to be kept in a liquid form, a small quantity of ammonia is used for the purpose.

To the second group, those prepared without heat, there is a great objection, viz., the excessive moisture of the rubber, caused through the outer portions being acted upon first, and thus enclosing the watery part in numerous cells. Great pressure is necessary to free the rubber from the watery part, and this is not always available.

Purity, and freedom from false packing, are of the greatest importance. The adulteration may arise from—1. Careless collection, in letting fall pieces of bark, &c., into the milk, or in mixing the milk of another tree. As is well known, there are numerous lactiferous trees, and a collector is not always careful, especially as with him quantity is the motto, and not quality. 2. Bad preparation, in allowing pieces of clay, &c., to drop into the milk or remain in the bottles after being used as moulds. 3. Intentional fraud. If anything tends to depreciate a rubber, however good its quality may be, it is this "false packing," clay being too plentiful in this country to justify paying 1s. 6d. or 2s. per lb. for it.

In the specimens of Mozambique rubber on the table, one has a large piece of heavy wood in the centre, and only a mere coating of rubber covering it. Any one having to do with the preparation and importation of rubber should look to this, as requiring the very greatest attention. It is by far the better plan to prepare the rubber in flat slabs, like the "biscuit Para," as this gives a buyer confidence in the article, because adulteration becomes much more difficult.

II.—SUPPLY.

The want of a larger supply of good caoutchouc, and at a lower rate than manufacturers have to pay at present, is much felt. To go no farther back than 1861, the highest price paid during that year for fine Para

* Prod. Veg. du Portugal, p. 20.

† Failing these other palm fruits are used.

rubber was 2s.; last month it was 3s. 3½d. The question has naturally been asked, What is the cause? and to answer it I cannot do better than quote from a note forwarded me by Messrs. Rayner and Co., of Liverpool, and written by Mr. Augustus Tappenbeck:—

“*Para*.—This year’s crop will probably fall short of last year’s, the reasons being want of hands, caused by constant recruiting for the war, and the natural decrease of the Indian population. The districts in which the largest quantities of rubber are collected are very unhealthy. The rubber trees abound most on the banks of the rivers, which, during the rainy season, are under water. With the beginning of summer, when the rivers begin to fall, the principal season for collecting commences, and the people have to work in mud, and surrounded by decaying vegetable matter, which produces fever and ague in white people, whilst the Indians and blacks do but rarely suffer from the disease.”

“*Ceara*.—The annual crop does not amount to much; people collect rubber only in the intervals when they are not occupied with their cotton and coffee plantations, which takes nearly all their time.”

Mr. Tappenbeck also mentions that the right of collecting the rubber of Pernambuco and of the adjoining provinces has been leased to one individual, but who, for want of hands through the war, is doing nothing. Such has been, and ever will be, the case, where the native populations have to be depended on. No amount of persuasion will induce many of them into making an effort beyond their own inclinations. In Africa, the trading stations are in most cases at least dependent on the caprice of the natives. They bring products for barter, and the wars and quarrels of their chiefs are constantly interrupting the trade. Such being the case, it becomes necessary to see whether these matters can be remedied. This can be done in four ways, opening new sources of supply, by preserving and improving existing ones, and by cultivation and acclimatisation.

Of new sources of supply, I cannot help looking with considerable interest on the vast resources of Africa and the Malayan Archipelago. The vegetable wealth of these must be enormous. South America, too, is susceptible of much improvement. India is far behind-hand. The *Ficus elastica* is easy of cultivation, and Assam should furnish good caoutchouc in large quantities. The *Ficus elastica* is so abundant in Assam and Cachar as almost to form forests. Dr. Anderson, the Director of the Calcutta Gardens, and formerly Conservator of the Forests of Bengal, says that the right of collecting india-rubber has been leased, for periods of six or seven years, principally to natives, the sum paid being about £1,000, and that he fully intended, when other urgent forest business would admit, to place the india-rubber forests under the direct control of the Forest Department. This his successor has done in the present year. Under the old system of long uncontrolled leases, the trees were much injured by overtopping, as each lessee endeavoured to get as much out of each tree as possible. The best manner, however, of preserving the Assam india-rubber trees, and the improvement of the manufacture, is at present engaging the earnest attention of the district officers and of the Forest Department.

Here let me say a word respecting the injury done to india-rubber trees by natives, as showing the necessity of conservation. This injury is of three kinds—1. Overtopping; 2. Binding the trees in order to obtain a greater quantity; 3. Total destruction of the tree. With regard to the second, this is found in Brazil to do the trees a great injury, and rendering them liable to the attacks of insects, and death follows as a matter of course. With regard to the total destruction of trees, the reason generally given, especially with respect to the gutta-percha tree, is that otherwise the collection of such products would prove unremunerative; but this is not the true reason. Wherever proprietary right or

conservancy does not exist, total destruction of trees will be the rule. The only valid reason ever given by a native has been, if he spared the tree, others would not, and that he did not see any reason why he should not enjoy the full benefit himself, rather than leave it to others. In fact, there are many natives who do not like cutting down trees, as, beside the labour, they have constantly to shift their field of operation.

In closing these remarks, there is one subject which I would more especially recommend to the attention not only of those present, but also submit to the attention of her Majesty’s government, that is, the acclimatisation of the different species of *Hevea* (and also incidentally I would mention the species of *Isonandra*, which yield gutta percha) in such of our eastern possessions as will be found best suited. The introduction of the invaluable cinchonas into India has been attended with marvellous success, and is alike an honour to this country at large as to those scientific men who have been engaged in the undertaking. Though I would not plead an equality of value in these articles, yet all will agree that fine descriptions of india-rubber are sadly needed; that increasing supplies do not seem to be forthcoming; and that the *Para* rubber, furnished by the species of *Hevea*, is superior to any other.

Thus, gentlemen, I have endeavoured to lay before you a few facts on this interesting subject. There are many other points which I should have liked to have brought under your notice, but these I must reserve, if thought of sufficient value, to a future occasion, when I may again have the honour of addressing you.

DISCUSSION.

The CHAIRMAN said it must have struck everyone as a curious fact, that a substance of such extraordinary value, and possessing such remarkable qualities, should only have been extensively used within the last few years. Caoutchouc did not appear to have been known at all to the ancients, not being mentioned or alluded to in any of their writings, and in fact its properties had been entirely unknown in the eastern hemisphere, although, as they had heard, it abounded there. It was reserved for the American Indians to discover the extraordinary properties of this article, and, as they would no doubt remember, it was Columbus who brought the knowledge of it to Europe. He found the Indians of St. Domingo amusing themselves by playing with balls made of india-rubber, and when, shortly afterwards, Cortes went to Mexico, he found that the jesters at the court of Montezuma used to dance before the Emperor in shoes made of that substance. It had been said of old that there was nothing new under the sun, and it appeared that what was called macintosh cloth was well known to the American Indians and their Spanish conquerors. It was very curious, therefore, that such a thing was not appreciated by Europeans for so long after it was known; but this was the case with many great discoveries. India-rubber had been spoken of and written about by various persons, but it was not until the last century that it came into use in England, and then only to a small extent, for rubbing out pencil-marks on paper; hence the name india-rubber, to which Mr. Hancock objected as being too long, while he thought caoutchouc difficult to pronounce. He therefore advocated the use of the term “rubber” alone. He (the chairman) saw no objection to the word “caoutchouc,” and thought it would ultimately prevail. The supply had kept tolerably equal to the demand until of late years, when fears began to be entertained that there would be a deficient supply. He himself did not share those fears, because there was such an enormous extent of country yet remaining to be explored, in different parts of the globe, where india-rubber might be found. They all knew, for instance, that on the American Continent there were immense virgin forests, only known

to Europeans by the rivers which passed through them, and from the highway, as it might be called, across the isthmus of Panama. As soon as they began to make railways, as they were now doing in Honduras and other parts, there was no doubt but that a great number of india-rubber trees would be discovered. In Nicaragua there were large tracts of country entirely unexplored, some of which were inhabited by hostile Indians, particularly one district, about which a great many curious stories are circulated. No white man had ever penetrated up these rivers until within the last few years, when the high price of rubber induced some of the collectors to make an attempt to penetrate into the interior, in search of caoutchouc, and forming a strong party, well armed, they succeeded in their endeavour. This was the country between Nicaragua and Costa Rica, to which allusion was made in the paper. He had no doubt that when the country was opened up, almost any amount of india-rubber could be obtained, and the same thing would, no doubt, be true of Asia and Africa. There were a great number of plants which yielded this material, the genus *Ficus* alone consisting of several hundred species, all of which yielded milk capable of being converted into caoutchouc of more or less value. Again, the cultivation of caoutchouc trees might turn out very profitable, inasmuch as they grew with great rapidity, and did not require much attention after once being planted. Under regular treatment, they might be tapped every two or three years, and no doubt they would yield very profitable returns. One thing which made india-rubber expensive was, that the trees did not seem to grow in forests, but were scattered about amongst other vegetation, so that the collector had to waste a good deal of time in searching for them. A great deal of time was saved in Nicaragua and Central America by thickening the milk at once after it had been collected, various plants being employed for this purpose. Until within the last few months it was not known what these plants were, but he (the Chairman) had succeeded in identifying one, which was a kind of convolvulus, very abundant there. After employing the juice of this plant, the milk at once became thick, and was easily dealt with.

Admiral Sir EDWARD BELCHER said one of the reasons why india-rubber did not find its way to this country from Panama at an early period was, that at that time it was simply used here for rubbing out pencil-marks, and consequently there was not much demand. To his knowledge there was, in 1836, a very extensive trade carried on there by the acting Vice-Consul, but all he could procure was taken by the United States. In fact, he (Sir E. Belcher) had found, all over the world, that wherever anything would fetch 1s. per lb. in the English market the Americans would intercept it, and pay 1s. 6d. He believed some of the finest india-rubber which he had seen at Panama in 1836 was equal to any specimens exhibited on the present occasion; and in Borneo he had seen specimens in use by the natives quite equal to ordinary bottle rubber. In the year 1832, while he was in the United States, he saw little grotesque ornaments of India rubber, such as were so much in use in England about twenty years ago. With regard to the Eastern sources of supply, he might say that Singapore might be considered as the London of the East, all the products of the different countries in that quarter of the globe being received there by the native traders, who came in their prows. Sumatra, Borneo, the Spanish possessions, and even the settlements on the Irrawaddy, all sent their products to Singapore, because the Chinese bought up everything they could get hold of there, and there was an immense demand for india-rubber throughout China, for making varnish. When at Macao, he had some gold-size given him, the finest he had ever seen, as would be proved by the fact that the trucks of his ships were gilt with it, and, after six years, they looked as fresh as on the first day. With regard to our present supplies, it must be

borne in mind that the caoutchouc must be purchased by the agent abroad at such a price as would enable him to send it to England at a profit. As far as the plant itself was concerned, he believed that all forests in foreign lands were free property, and that they could not be protected in any way by law; and with respect both to india-rubber and gutta-percha plants, if they attempted to remove the other trees which protected them, they would very soon die; that he had seen both at Borneo and Singapore. When at Borneo, Dr. Oxley gave him some of the first specimens of gutta-percha, which were now in Kew museum, and furnished him with guides for an excursion into the country, in search of the plants. He had never seen the process of manufacture, but he had seen the result, and he was informed that the way in which the finest india-rubber balls were made, was by using a strong reed or porous rush, and treating the india-rubber like a soap bubble, dipping the reed into the milk and blowing very gradually until it was about the size of a cricket-ball; it was then tied to prevent the escape of the air, and hung up to dry.

Mr. COLLINS then proceeded to describe several of the specimens on the table, remarking incidentally that the dark colour on the outside of the india-rubber was due simply to exposure to air, for the darkest kinds externally were often nearly white below the surface. With reference to the adulteration of rubber, there was in the Kew Museum a curious specimen of Negro-head rubber, which he had sent there. There was an external coating of caoutchouc, inside which was a large ring of earthenware, and inside that again cloth, reeds, clay, and other rubbish, so that the weight of the rubber itself was not more than one-fifteenth or one-twentieth of the whole mass. This was always the case, more or less, with this description of rubber, and the consequence was that it did not fetch anything like the price it was intrinsically worth. With regard to Singapore rubber, also, the great fault was its adulteration with sand and bark, the natives trying to make it as heavy as possible. The specimen from Java was very interesting, being in the form of the ropes spoken of by Dr. de Vrij as being used for torches. It was of the utmost importance that every one connected with this branch of commerce should take every opportunity of impressing upon the agents abroad the necessity of procuring the caoutchouc as free from adulteration as possible. He might also mention that many of the milks from which the rubber was prepared were very palatable, indeed, he had been informed by one European that he had been in the habit of mixing it with his tea and coffee, until he saw one of the natives using it for sticking together pieces of cabinet-work, when he discontinued it.

Mr. WALTER HANCOCK said the subject of the paper had been treated from a point of view from which the manufacturer hardly ever regarded it, viz., the geographical and botanical. Some of the remarks of Mr. Collins were similar to what he (Mr. Hancock) had ventured to make on former occasions. For instance, in the collection of vegetable matter of this kind it was most important that the right season should be chosen, and that it should be taken from a healthy tree of mature age. Among the reasons why the india-rubber and gutta-percha when first introduced into England appeared perfectly sound and satisfactory, and afterwards turned out to be quite the reverse, was, he believed, the neglect of these precautions. With regard to what had been said as to calling the attention of those who collected india-rubber and gutta-percha to the importance of getting it pure, he must say that, for many years past, the strongest representations on this subject had been sent to the merchants abroad, who bought it direct from the natives. But, in dealing with people like the Indians, it was found that you must take what they thought proper to send, or nothing at all. It appeared that in Para they had at length arrived at a traditional and perfect mode of collecting it, but in

other parts, where it had been more recently found, the process appeared very rough indeed. More particularly was this the case with regard to East Indian rubber, and that which came from Singapore, Sumatra, Borneo, and the adjacent districts. With regard to the collection of gutta-percha, he had several times sent out very carefully selected samples, with a long list of hints that he thought ought to be attended to, but this did not seem to produce much effect. Some samples of Balata gum, which was somewhat intermediate between india-rubber and gutta-percha, had been sent over by Sir Wm. Holmes, which appeared perfectly pure, not having even a half per cent. of impurity. And there certainly appeared no reason why, if the same skill and care were devoted to the collection of india-rubber and gutta-percha, a similar result should not be obtained. There was no doubt as to the immense importance of this part of the question.

The CHAIRMAN said one of the great advantages of the meetings of the Society of Arts was, that men of science and manufacturers could join hands, and each discuss any particular subject from his own point of view; whereas it was too often the case that science and practice were kept distinct. He should, therefore, much like to hear some further observations from any manufacturers who might be present.

Mr. P. R. Hodge quite agreed with the Chairman, that if any manufacturer or person thoroughly acquainted with the practical application of india-rubber could be found to contribute a paper on this subject, to supplement the one they had just heard, it would be of the utmost value. He must compliment Mr. Collins on his valuable paper, which showed an immense amount of research; but he feared that such a paper as he had described would not be forthcoming, knowing, as he did, a great deal of the manufacture and how many secrets there were in the trade. To give one instance, a gentleman, who was present, had spent twenty years in endeavouring to make one article, and he was just now beginning to reap the benefit of his experiments, and had obtained a patent. For a long time he had been able to get the correct form, but not the composition, but he had now obtained that, and there was no other manufacturer who could produce the article. There were, as he had said, so many secrets in this trade, which each one kept to himself, that he much doubted whether such a practical paper as he had spoken of could be obtained, but there was no doubt, if it could, it would be invaluable.

The CHAIRMAN then proposed a cordial vote of thanks to Mr. Collins for his valuable paper, which was carried unanimously.

Proceedings of Institutions.

ROYAL POLYTECHNIC INSTITUTION CLASSES.—On Friday evening, the 10th December, Dr. William Brewer, M.P., distributed to the successful candidates of the evening classes at the Polytechnic Institution the prizes awarded for proficiency displayed by pupils at the examinations of the Society of Arts, of the Department of Science and Art at South Kensington, and of the City of London College. The number of students during the past year have averaged 400 each term, being a small increase on the preceding year, and an increase of about one-fourth over the number of five years past. The pupils had been very successful at the examinations, having gained, besides the Prince Consort's prize of 25 guineas, two first prizes of £5 each, and three second prizes of £3 each. About £40 had been added in prizes from the donation fund. These prizes consisted, for the most part, of useful works and instruments.—Dr. Brewer said that, while elementary education had been engaging universal attention, and whilst it was such a question as ought to occupy the attention of every lover of his country, and while there was in truth no collision between this and

the subject of denominational education, there being ample room for both, there was another cognate subject which the Polytechnic Institution had taken up, which was likewise of the utmost importance, namely, technical education. No great step could be made without a deep knowledge of the laws of nature, and it was to this knowledge mankind were indebted for improvements in manufactures, science, and the arts, and without advances in this knowledge England would be distanced in the race. It was needless for him to say that the Polytechnic Institution gained nothing from these evening classes. They were purely philanthropic on their part. He bore a high testimony to the long-continued and valuable exertions of the Rev. C. Mackenzie and Professor Pepper.—The Rev. C. Mackenzie congratulated the students on the Prince Consort's prize having been again gained by one of their number. They had three examinations, one at the Society of Arts, one at South Kensington, and one at the City of London College. To all these bodies they were much indebted. For the Prince Consort's prize the work must be continuous, and it was the result of four years' success. He had informed her Majesty that this prize had been won for two years by students of the Polytechnic, and the Queen had been pleased to send to the library of the institution copies of the books which she had edited, containing the following words:—"Presented to the Evening Classes at the Polytechnic Institution. Victoria R." The pupils of the evening classes had gained 21 first-class certificates, 40 of the second class, and 35 of the third. They had gained, including the Prince Consort's prize, prizes amounting to £45 5s. out of a total of £306.—The successful candidates were then called forward to receive their prizes:—Mr. H. Fisher, who had obtained four first-class certificates, and a prize of £3 from the Society of Arts, was loudly cheered; Mr. J. G. Riorden had gained three first-class and one second-class; Mr. H. Spriggs, who had, in a competition with 253 others, taken the second place in book-keeping and a first-class in arithmetic, received also £3 from the Society of Arts. The number of successful candidates was 96 in all; several also had obtained prizes from the Society of Arts. The hero of the evening was Mr. W. J. Wilson, who had gained the Prince Consort's prize (presented to him at the opening meeting of the present session of the Society of Arts), as well as two prizes of £5 each, and one of £3 from the Society of Arts. The subjects for which his six first-classes this year had been gained were metallurgy, magnetism, &c., civil government, political economy, and logic and mental science, four from the Society of Arts, and two from the Science and Art Department, South Kensington. This gentleman was called up last, and to him Dr. Brewer presented a purse containing twelve guineas, amid loud cheers from those assembled.—Mr. Wilson, on receiving his prizes, begged to say that if encouragement and assistance made successful students, it was natural to expect that those of the Polytechnic would succeed, for they received all possible aid and encouragement in their efforts, and he begged to thank the committee for that which had been so kindly bestowed upon himself.—The Rev. J. B. Owen proposed a vote of thanks to Dr. Brewer, which was seconded by Professor Pepper, and passed unanimously.—Dr. Brewer briefly returned thanks, and the meeting terminated.

CITY OF LONDON MIDDLE-CLASS SCHOOL.

On Thursday, the 19th December, the Chairman of the Council, Lord Henry Lennox, M.P., and Mr. Edwin Chadwick, C.B., Mr. Hyde Clarke, members of Council, with Mr. Bartley, auditor, attended the distribution of prizes at the City of London Middle-Class School. The LORD MAYOR took the chair. Amongst those present were, besides the Lord Mayor and Sheriffs, Sir William Tite, M.P., Mr. George Moore, Mr. J. P. Gassiot, Mr. C. K. Freshfield, Mr. Philip Cazenove, the Hon. and

Rev. S. Best, Mr. Arthur Hobhouse, Q.C., the Rev. Canon Robinson, Mr. Clifton, the Rev. William Rogers, M.A., hon. secretary, and the Rev. Mr. Jowitt, the head master.

The school contains upwards of eight hundred children, chiefly of shopkeepers. About 20 per cent. of the children may be said to be of the foremost artisan class, such as the foremen of warehouses, railway-station masters, and the like. The children are not admitted before their seventh year, and the majority enter by about their eighth year. They come from an average distance of about three miles from the school. Some come by railway as far as from Croydon, Woolwich, and Leyton (in Essex), and they come because they can find no education within their respective districts as good. The school fee is £1 per quarter.

The pupils with the best previous preparation, come from the national and other schools under trained teachers, such as those at the Home and Colonial schools, or the Birkbeck schools; the worst from the small academies, or the private adventure schools, usually of a single master, with one usher, from few of which, though many charging much more than £1 a quarter, do the children get much beyond the three R's before the fourteenth year, and without music or elementary drawing, or any foreign language, or any physical training whatsoever. This middle-class school, indeed, contrasts with the schools of the more expensive class, such as those in which had been educated 437 gentlemen, from 1851 to 1854, both inclusive, of which number 132 failed in English, and 243 in arithmetic.

The teaching power applied to the children in this middle-class school is that of seventeen teachers; all (except four who have been at the universities) from the training colleges, and from practice in elementary schools. These are assisted by the occasional services of four scientific lecturers.

The teaching is in classes of fifty each, which are deemed very large for first-class teaching, but which is justified in this instance by the great number in the school, enabling so many classes to be each got up to the same plane for teaching, and this is, moreover, justified by the results.

The attainments up to the 11th year, taken as the nominal period for children of the wage classes, and up to the 14th year, the nominal school period for the great body of the middle classes, are as follow:—

Attainments at End of the 11th Year.

Reading:—To read fluently.

Writing:—To write a clear round hand.

Arithmetic:—The simple rules, vulgar fractions, decimals, practice, and proportion. To perform mental calculations with rapidity.

Grammar:—To classify words and analyse simple sentences.

English history:—Outlines.

Geography:—Physical geography of the world; Great Britain and colonies.

Dictation:—To write from dictation passages of not great difficulty.

Drawing:—Free-hand.

French:—The French verbs. To translate simple sentences from French into English.

Drill:—To march in columns, companies, sub-division; to form files two deep, four deep, or companies on the march.

Attainments at the End of the 14th Year.

Reading:—To read with expression an ordinary newspaper article, or an extract from any of the best poets or dramatists. To recite passages from several classical writers in English.

Writing:—To write a commercial hand.

Arithmetic:—The ordinary rules.

Algebra:—To end of quadratic equations.

Geometry:—The geometry of Euclid's first six books.

Mechanics:—Elementary mechanics; physics.

Chemistry of the non-metallic elements, and a few of the metals.

Elements of descriptive botany and zoology.

English:—The English grammar; outlines of English literature; the works of a few standard authors.

Geography:—Commercial geography of the world.

French:—To translate several French authors; to translate simple sentences into French.

Constitutional history of England, and outlines of the history of Europe.

Drawing:—Freehand, geometrical, perspective, architectural and model drawing.

Drill:—Same as the lower half, with a few additional manœuvres.

All classes are exercised in vocal music, and some of them, forming the band, are taught instrumental music. The singing on the present occasion was very good.

The pupils are proved in examination to be well up in their attainments; but, great as these are, as compared with the common school attainments, it is declared, and it is evident, that if all came in as well prepared as a few are from the Home and Colonial and the Birkbeck schools, the standards would, by the present teaching-power, be gained a year or more earlier.

After a few remarks from the LORD MAYOR,

The HEAD-MASTER read the more material portions of a report by Mr. J. G. Fitch, one of her Majesty's Inspectors of Schools, and Assistant-Commissioner to the Schools' Inquiry Commission, made to the Senate of the University of London, at their request, on the new school established by the Middle-class Corporation. In that Mr. Fitch said he had visited the institution on the 21st of June and following days. He had the great advantage, he said, of Dr. Carpenter's personal assistance in relation to the papers on physiology. Professor Cassal took charge of the examination in French, and Dr. Mills of that in chymistry and physic. Dr. Bidlake also rendered useful service in some of the elementary work, and in revising the papers on geography and history. The detailed examination extended over eight days, and Mr. Fitch subsequently spent three mornings in visiting each class in succession, with a view to observe the condition of the school in its normal state, and to estimate the methods of instruction adopted by the various masters. All, he said, were men of experience, accustomed to oral teaching and to the handling of large classes. The general character of the school was remarkably life-like and intelligent, and its effects on the mental activity of the pupils were very marked. He had rarely seen a school so thoroughly pervaded with the spirit of work, or affording such strong evidence of the sympathy and interest with which the scholars followed the explanations of their teachers. Nothing could be more satisfactory than the discipline of the whole establishment. It was maintained without any corporal punishment, and its excellence was largely owing to the personal influence of the head-master, and to the loyalty with which he had inspired the boys. It was also in a great degree attributable to an excellent system of drill. At the beginning and end of each day the boys were assembled in the large parade-ground, each class headed by its own master, and went through various quasi-military movements and evolutions. They marched in companies to the music of their own brass band, which had been organised and taught by Mr. Alcock, one of the masters, and were thus acquiring, not only healthful physical exercise, but a manliness of bearing and a pride and interest in their school which were very striking, and are of great value in the formation of character. Latin was not included in the school course, and the reasons which had led the head-master to omit it appeared to have much weight. The slender knowledge of Latin attainable by boys who were leaving school for business at 15 often proved a very sterile possession, yet it

was apt to be rated at an undue value, and to absorb a disproportionate amount of the time of teachers and scholars. Mr. Fitch could not, therefore, doubt that in determining for the present, at least, to make the systematic study of English and French the substitute for the linguistic training usually aimed at, though so seldom attained, by means of Latin in middle-class schools, the authorities of this school had exercised a wise discretion. This impression was strongly confirmed by the performances of the boys of the sixth form, who, besides a very careful analysis of a difficult English sentence, evinced a good critical knowledge of a play of Shakespeare, and of two books of Spenser, commented with great accuracy on some of the archaic and less familiar words, and showed by their paraphrase and written composition that their studies had taught them to use their own language with some precision and judgment. On the whole, notwithstanding the great mental activity which prevailed throughout the school, he was inclined to wish for rather more of the discipline which tended to throw boys on their own resources, and make them work out difficulties by themselves. An excess of sympathy and assistance, a readiness to anticipate a learner's difficulties by oral explanation, was not a common fault in schools, and, if it was a fault, it was one on the right side. But there was a little tendency to it in the teaching of English grammar, geography, and history there, and that tendency might be usefully corrected by the adoption of good text-books on those subjects, and by the infusion of a rather larger proportion of written and memory exercise into the scheme of the teaching. He was quite aware that considerations of economy had largely influenced the head-master in regard to the adoption of books, but he could not believe that, when so much excellent work was already done, parents would object to the purchase of such text-books as might be needed to give effect to the valuable oral lessons of the masters, and to fix with clearness and exactness those lessons on the memory. It only remained for him to say that Mr. Jowitt kindly conducted him over the new premises in Cowper-street. They were commodious and well-arranged, and provided accommodation for 1,000 scholars. The class-rooms would give room for the movement and variety of arrangement which were so seriously lacking in the present temporary premises. All the plans for dining and for recreation, as well as for teaching, had been thoughtfully devised, and the new building would seem to him complete but for one want;—a large hall, capable of accommodating the whole school, was much needed, not only for public and commercial occasions, but also for those gatherings of all the classes for special purposes which were so necessary in sustaining the unity and efficiency of the schools.

THE LORD MAYOR—I have heard that report read with great pleasure, but, as an old mercantile man, I cannot but think there is one great omission—namely, that there are no boys' copybooks to be seen—no writing; and so biased am I in favour of good writing, that I take it to be a great test of itself. I hold that in writing we are behind-hand; we are going back. The school-masters of the present day think themselves above teaching handwriting, and we have scrawls forced upon us in the shape of handwriting, which are nothing more than hieroglyphics. You will excuse me, Mr. Jowitt, for making this suggestion.

THE HEAD MASTER explained that, for the sake of brevity, he had omitted to read from the report the passage in reference to the writing of the pupils. He read it now, and it was to the effect that in the school every boy either wrote, or was on his way to writing, a clear legible hand, sufficient for all business purposes.

MR. ARTHUR HOBHOUSE, Q.C., said it must have been gratifying to all present to hear the great success of the school. Perhaps none of the company, however, looked at it with precisely the same feelings as himself, for his memory carried him back to the earlier exploits of his

friend the honorary secretary (the Rev. William Rogers) in the cause of education. He remembered the time, some 24 years ago, when his friend went alone, and equipped only with his own energy, into some of the most neglected parts of London, and, finding there great masses of people without any means of education, moved heaven and earth, so to speak, and ultimately succeeded in establishing three schools for the education, in all, of about 3,000 children. Now they had a school which promised to be as useful and enduring as any the citizens of London, in their munificence, had ever set on foot. They had there a school which educated 800 boys, and gave them a training fitting them for any career to which their talents entitled them to aspire. It was a great success, and those who had achieved it might well rest for a moment and look back upon it with a feeling of satisfaction. They saw it in full and efficient working, but time ran on, and the problem arose how the continuance of that working was to be insured. The school was not capable of being supported entirely by the payments of the parents. There must be a combination of income from real-ised property and a payment for value received. Of the extent of the funds belonging to the Corporation, and of the claims upon them, he knew nothing. He did happen to know, however, that there were large funds taking their origin in the City of London, and expended within it, which were doing little but mischief now, but were capable of being applied to the aid of this good work. That kind of almsgiving was, after all, a selfish habit, springing partly from pity and partly from superstition, and defended by ignorance. Would they not aid in diverting the funds which were feeding the evil, and in applying them to the cure? In some cases the ordinary powers of the legal tribunals would suffice for the purpose. In the last session of Parliament, however, a statute was passed creating a new tribunal, which, if acting in combination with the trustees of an endowment, had very large powers applicable to that very purpose. He asked the Council of the Middle-class Corporation to show themselves worthy of the confidence which had been placed in them, to look around and see what funds there were, how they were applied, and, if they thought change was needed, to gird up their loins to effect it. It would be good work, and good men would honour them for it. Endowments might be made excellent servants, but were most miserable masters. The men who, at or about the Reformation, set themselves to found schools, defined their objects with wisdom, and pursued them with simplicity. They held grammar to be the key to the noble science of antiquity; they guarded the schools they founded from priestly influence, and, in the result, secured for us that freedom of thought and action which had made us what we are as a nation, and which was a noble inheritance to be transmitted to posterity.

LORD HENRY LENNOX, M.P., speaking as Chairman of the Council of the Society of Arts, bore witness to the admirable work which was being carried on in that great middle-class school. He had visited it himself, and had made himself master of the system of teaching in practice there. He was also present recently when Dr. Lyon Playfair put the boys through their scientific "bearings," and was extremely well pleased with the result. As to good writing, nobody was probably more aware of its value than he (Lord Henry). For three years he held an onerous post in the Government, and he had painful experience of how much valuable time was lost there in deciphering the difficult, and often inscrutable, hieroglyphics in which even great questions of State were sometimes involved; and he must say that some of the greatest offenders in that respect were amongst the noblest of the land. He for one wished to offer a public tribute, on the part of the Society whose mouthpiece he was, to the noble manner in which difficulties had been surmounted in the establishment of this school, and shoals avoided. The movement so begun could not stop there. Its very success made one long to see such schools

multiplied and extended throughout this great country. He hoped the day had now come when there would be some definite action upon this important subject. Public opinion was ripe upon it; for years it had been discussed in and out of Parliament and in the press, and the English people now desired to see a system of popular education placed within the reach of every one. While he wished to see a comprehensive measure of instruction, he deplored the time that had been lost, up to this point, in meeting the great want of technical education. They had always, in those matters, to consult a certain "bogie," in the Chancellor of the Exchequer for the time being, and he wanted them to tell the present Chancellor of the Exchequer, or any other, that the country did not consider the appropriation of money for such purposes as waste, but as true economy. He sincerely trusted Mr. Forster would be able to present a sound, comprehensive, and drastic measure of education in the forthcoming session of Parliament, which he was sure his would be when it came, and so dispose of a solid grievance before the legislature was engaged in considering a sentimental one. Addressing the boys before him, Lord Henry said the future of their lives, under God's Providence, was in their own hands. The children of the middle-class might now obtain an education which was far more adapted to the position in which they might pass their lives than that of the wealthier classes. He belonged to one of what was called the "leisure" classes, and his education commenced at Westminster and finished at Oxford; but he now regretted that he had not had the chance, when a boy, of being instructed in such a school as this. Again, he said, the future of the boys before him was in their own hands. There was no country like England in which men could rise by their own merits, and it was, after all, merit and not birth which won the most honours and the most solid and lasting reputation. In future years, when some of them had reached the summit of their ambition, they would then look back with satisfaction to their connexion with this school. He sincerely hoped they would soon see a belt of such institutions surrounding this vast metropolis. What with the City companies, the public feeling on the subject, and with a government measure properly devised and introduced, he trusted also that such schools would be greatly multiplied throughout the country, and form in the end an insuperable barrier to ignorance and her too frequent sister—crime.

Sir WILLIAM TITE, M.P., speaking for the Council, of whom he is one, expressed their obligations to the Lord Mayor for extending his countenance to the ceremony, and said they hoped before long to establish a similar school, and one just as useful, on the south side of the Thames.

The LORD MAYOR then distributed the prizes.

Mr. C. K. FRESHFIELD, a member of the Council, bore testimony to the complete efficiency and self-devotion of the head-master (Mr. Jowitt), and said they had been fortunate in obtaining such a man. He also referred to the harmony with which the subordinate masters co-operated with him.

The Hon. and Rev. SAMUEL BEST expressed his deep interest in the school, and earnestly hoped next year some general measure would be carried, which would remove the difficulties and obstacles that, in various forms, had hitherto prevented the education of all classes, he would not say on a secular, for he disliked the word, but on an unsectarian basis.

At the instance of Mr. J. P. GASSIOT, F.R.S., and Sir WILLIAM TITE, M.P., cordial votes of thanks were presented to the Lord Mayor and to Mr. Alderman and Sheriff Causton and Mr. Sheriff Vallentin.

The LORD MAYOR, referring to an enthusiastic cheer which the 800 boys raised at the mention of his name, said—That is my prize; I shall take it home with me. Any man who has ever thought kindly of his fellow-men, and who will not come forward to help the cause of general education, is unfit to live in a free country. I see

instances every day which convince me that the sources of education have been choked up with Latin and Greek. They were all very well in their way, but of no use to a working man's son. I believe this school contains the germ of a great institution, and that it will tend to make men—emphatically men—of the boys.

The Sheriffs acknowledged the compliment paid to them, and with that the ceremony terminated.

BIRKBECK SCHOOLS.

THE PECKHAM SCHOOL, LONDON.

By GEORGE C. T. BARTLEY.

The Birkbeck schools which exist in the following places, viz.:—Southampton-buildings, Chancery-lane; Peckham, Hackney, Gospel-oak-fields (Kentish-town), and Bethnal-green, have been established almost entirely by the private liberality of Mr. William Ellis. In numerous parts of the country, schools are in existence on a similar principle, though they do not bear this special name; they are institutions where not only an elementary education is given at a comparatively low cost to children, but where a higher and even an advanced training is obtainable. Two chief characteristics are, first, that they are totally unsectarian, no religious dogma of any description being inculcated; and, secondly, that they do not receive any grants from the Education Department for elementary instruction. Another feature which may be considered as almost peculiar to them, and in which, at the time of their commencement, they were quite unique, is the instruction given in the elementary principles of social and political economy.

It may be said that the idea of increasing the knowledge of the principles which must be at the root of all commercial and industrial pursuits, was one of the chief objects which led Mr. Ellis to create these institutions. The great ignorance displayed by so many persons, in questions such as the currency, strikes, and panics, he had noticed for many years, and it had induced him to write several valuable educational books on these subjects, giving, in simple and easy language, the true principles of these important topics. He finally resolved to establish schools in which these subjects would be taught in a pleasing and intelligent manner. This is fully described in the following extract from Mr. Knight's "English Encyclopedia":—

"Since his childhood, Mr. Ellis has seen our currency, as at present established, assailed in every panic from that of 1825 to that of 1848; and during the same period there have passed under his scrutiny all the great strikes by which workmen have been deluded into the hope of alleviating the sufferings incident to insufficient wages. These evils induced Mr. Ellis to make some attempt at removing them; and, further impelled, it may be, by the kindly feelings towards children which form a prominent feature in his character, he determined, if possible, to introduce into schools such instruction as should send boys into the world furnished with intelligent thoughts upon all the great questions relating to industrial life. With this view he began, in 1846, a series of lessons to the elder boys of a British school, to which, for some years previously, he had been accustomed to render assistance; and, about the same time, he also gathered round him a group of schoolmasters, with whom he went over the course of inquiry which will be found in his 'Progressive Lessons,' and these lessons will also furnish a good illustration of the mode of teaching adopted. The boys had no tasks to learn by rote, but the whole of the subjects brought before them, with the exception of things merely technical and arbitrary, were, so to speak, developed by the boys themselves, they being guided in their inquiries, of course, by the questions of the teacher. Thus, these lessons came to be something more than the mere teaching of dry academical political economy; they assumed, in fact, the character of moral lessons. For,

thus taught, not only do children learn as a matter of fact about what is going on as the every-day work of industrial life, but they are continually invited to investigate what ought to be the rule of conduct of those who are engaged both in production and distribution. Not only, for example, would children learn the fact that the merchant does buy in the cheapest and sell in the dearest market, but the questions would come, 'Ought he to buy in the cheapest market?' 'Ought he to sell in the dearest market?' 'Why? or why not?' And such questioning, as may easily be perceived, when managed by a competent teacher, tends to a high order of mental and moral training. Having thus satisfied himself that social science may be made attractive to intelligent boys, and feeling certain that the habits of reflection and self-examination which its study calls forth cannot fail to impart a useful bias to their character and conduct in after-life, Mr. Ellis proceeded to establish schools in which instruction in social science should be a leading feature."

Such was the origin of these schools, which were named after the founder of the Mechanics' Institution in Chancery-lane, the father of all the similar institutions now existing in every part of the country. The reason which led to their being called after this eminent man was from the fact that the first school of this description, and the only one which was not absolutely established by Mr. Ellis, was commenced in Chancery-lane. Considerable difficulty was found in giving a special name to the schools, as Mr. Ellis modestly objected to his own name being publicly known in connection with them, and, after some discussion, they were called after the worthy philanthropist, Dr. George Birkbeck. This led to many narrow-minded persons objecting to the schools on account of Dr. Birkbeck's religious opinions not agreeing with their own; and to this day not a few have vague scruples concerning the schools, which are the more unjust, as, though strictly unsectarian, the moral tone of the children, particularly at Peckham, is considerably above that met with in most other schools.

It may be stated, from observations made at Bethnal-green and the other districts, that several interesting examples have been remarked of the appreciation often shown by comparatively poor parents for the value of an advanced education to their children. It frequently happens that great sacrifices are made, to enable at least one of a family to have the benefit of a year or two at the Birkbeck School, which is felt in the neighbourhood to give a sort of finishing education. If one of the boys in a family show great promise, he is sent there after leaving the elementary school. But generally the eldest son has the advantage; and, in some cases, this feeling of the rights of primogeniture is so strong, that the youngest children are sent to work earlier than they otherwise would be, in order to provide funds for continuing the studies of the first-born.

The following remarks, though relating chiefly to the Peckham establishment, apply, in principle, to the other Birkbeck schools, which, as before stated, are all conducted much on the same plan.

This institution, situated in a populous part of the south-east of London, was opened in 1852, under the management of Mr. Shields, who still conducts it. At its commencement it was on a somewhat smaller scale, but has increased from time to time, as the neighbourhood gradually appreciated the excellent education to be obtained in it, until, at the present time, about 600 children are daily under the instruction of fourteen teachers. All the children are day scholars, the greater part, of course, residing in the neighbourhood of Peckham, though a large number come from Walworth, and a few from even a greater distance. Of these about a quarter are girls. Those over seven years of age of either sex, have separate class-rooms and play-grounds.

The school is divided into two:—1. The infant-school for boys and girls under seven years of age. 2. The

junior school. 3. The upper school. The difference between these last two divisions does not consist in the grade of advancement of the children, but is more of a social difference, the payment being higher, and the children, consequently, belonging to parents of a higher position in life.

This arrangement is not adopted because it is the best, as no doubt a system such as that at Faversham, with a junior culminating into an upper school, would be far better, but the social class-feeling among parents renders this at present impossible. At the same time, in either division there is a considerable variety of children, this variety being greatest in the upper school, as promising boys, who stay longer than usual, though, perhaps, of the artisan class, find their way out of the junior division.

One great disadvantage of this social feeling, which prevents parents, whatever their position or means, from sending their children to begin in the lowest class and advance as they rise in learning, is the fact that it duplicates the elementary instruction. Many of the children in the upper school require the first lessons given to the lowest classes of the junior school, and, as they cannot be made into one class, a considerable amount of teaching power and time is lost.

The fees paid form a large part of the income of the school, though they are not quite sufficient to render it self-supporting. In the upper school they vary somewhat; but 12s. a-quarter is the general charge. At Hackney, no less than £1 per quarter is paid in some cases; in the lower school, 6d. a-week for those under eleven, and 1s. for those over that age. But even this limited fee of 6d., to some of the poorer pupils, is sometimes an occasion of irregularity. It is found absolutely necessary to charge some fee; but, during seasons of short work, the schooling is the first thing to be stopped, and, in the winter, if sending the child to school involves the purchase of a pair of boots, this will too often be the cause of a break of some weeks in its attendance.

The system of teaching largely adopted is that of question and answer—a mode advocated by Mr. Ellis, and carried on in this school with remarkable success. Few books are used, and the children are made familiar with the objects and facts which are being described to them, and in all cases, where possible, the black-board becomes an important auxiliary to the teacher.

A peculiarity of the institution is the entire absence of the usual stimulus given to pupils by prizes and rewards. Occasionally a book may be given to a boy on leaving, as a private present, but there is no system of competition for prizes in the different classes.

The highest boys in the school are formed into the monitor's class, and great care is taken to secure only those who, by private character and habit, are good examples of conduct, as well as apt teachers. These monitors during certain hours, take each a few of the lower classes and form what is called a collective class. Each small division of six or seven, under its monitor, is gathered round a black-board, and some problem in arithmetic or other subject is worked at by all; the monitor learning probably more than any by the repeated questions of his pupils. The teacher is stationed at one end of the room, and appealed to in all cases of difficulty. In this way nearly all the masters in the school have been trained.

Some attention is given to drill both with the boys and girls, but, with the latter, not to any great extent, and the whole time of the pupils is devoted to mental study, no part of the day being given to industrial training.

The subjects of instruction embrace those usually given in elementary schools, and, in addition, in the junior and upper schools, geography, history, French, drawing, and elementary and practical science.

The chief feature in the infant school is the great stress laid on instructing the children in printing. This is taught almost before writing, and, judging from the

excellent writing throughout the school, there can be no doubt but that the mode adopted is most successful in forming a clear, good hand. Another plan, which is carried on with the same object, is the method of requiring the children to copy sentences on large sheets of paper, which are needed from time to time to hang on the black-board, for the use of the classes. These are done with a broad quill pen, in letters an inch or more in size, and the work is found to give freedom and neatness.

Arithmetic is really taught at this school, for it is unfortunately a fact that but few places exist where intelligent teaching of this subject is understood. The girls show an aptitude and quickness which it is unusual to see for mathematical pursuits, so much so that it suggests that possibly the female deficiency of power in following mathematical facts and reasonings may, to a great extent, be due to the imperfect manner in which they receive instruction in elementary arithmetic. Text-books are here used but rarely, and then only for obtaining examples; the rules are practically explained in a common-sense manner, and each child's understanding of them is tested daily by numerous examples. By this means learning by heart is possible.

The amount of scientific instruction given to the children is considerable, and that, too, at an unusually early age. The youngest classes of the junior and upper school are taught the elementary principles of animal physiology and the laws of health. The mode of instruction in this is similar to that pursued in most other subjects, namely, by means of a conversational lecture, interspersed by frequent questions from both teachers and pupils. In all cases the lessons are accompanied with experiments, and all facts practically exemplified as much as possible. Thus, in explaining the nature of the skin and its uses, its physiological properties would be shown as bearing on the necessary requirements for keeping it in such a state as to enable it to perform its functions; from these, its commercial uses would be touched upon, as in the manufacture of leather and glue, and experiments made showing the processes used in these arts.

To both boys and girls this instruction is given, and it is probable that no school for children of a similar description in the kingdom is so advanced as for the highest girls' class to be able to understand some of the facts concerning the Darwinian system of development of peculiarities in animals, a subject which is not considered too abstruse in this institution. This result is arrived at, not by the cram and showy system so often developed out of public and competitive examination, but by a gradual course of agreeable instruction enjoyed by the children, and likely to be permanently impressed and to have an exalting influence on their minds.

The schools are open to all children presenting themselves, who pay the fees, provided they show proper respect to the rules and discipline. No religious doctrine is taught, and the parents of the children belong to almost every sect, the moral tone of the whole instruction being such as is rarely met among so large and so miscellaneous a collection.

In concluding these remarks, and in drawing comparisons between this school and others, it is not difficult to see why it is so eminently successful, far above schools under ordinary management. It is from the fact that the children enjoy the services of a head master, who, makes them his study, and whose whole mind and unusual powers are given to render the training of the greatest possible benefit to the children in his charge. It is to be regretted that such excellent institutions as this one at Peckham do not exist in all parts of London and our great towns. The only thing to prevent it is, no doubt, the difficulty of finding men competent and willing to undertake the duty, which is not often so highly remunerated as its importance would warrant. It is clear that wherever such schools are established, there is no

lack of parents of the industrial class willing and anxious to pay a considerable fee for a sound, or even an advanced education for their children.

SCHOLASTIC REGISTRATION ASSOCIATION.

The annual general meeting of this association will be held on Tuesday, January 11th, 1870, at four p.m., at the House of the Society of Arts (by permission of the Council), to receive the reports of the secretary, of the treasurer, and of the auditors; to elect ten persons to serve on the committee, and two auditors; and to take into consideration certain notices of motions, especially referring to the Educational Council Bill. A public meeting, convened by the association, will be held in the evening of the same day, at seven o'clock, at the same place, in support of the Educational Council Bill. The following resolutions will be proposed:—

1. "That this meeting expresses its entire concurrence in the proposal to register and classify teachers who have passed an examination held by the Educational Council, or some other recognised examination, or who have produced evidence of efficiency in teaching satisfactory to the Council, as affording a means whereby the public may distinguish qualified from unqualified educators, and as an inducement to future teachers fully to prepare themselves for the duties of their office, to the advantage at once of themselves, and still more of those whom they instruct; and that, in the opinion of this meeting, it is important that the Educational Council should, as far as possible, recognise practical experience in teaching as a condition of registration."

2. "That this meeting further suggests the substitution of the words 'Great Britain and Ireland,' for that of 'England,' in clause 13."

3. "That this meeting, while approving generally the proposed constitution of the Educational Council, believes that the appointment thereon of representatives of teachers elected from among themselves will be both just and wise, as tending to secure the cheerful confidence of all thus represented; and that, in order to provide for the due representation of the various branches of the profession, it is most desirable that of the three representatives of teachers, one be elected by the masters of endowed schools, one by those of 'Registered' schools, and one by the masters—if registered—of schools which are, or might be, under the direction of the Committee of Council on Education."

4. "That while this meeting fully admits the importance of registering teachers, it as firmly maintains that no reform of education will be complete without a far more widely extended and well-organised examination of schools, as proposed in the Bill,—obligatory in the case of endowed schools, and permissive in that of others—either by persons appointed by the Educational Council, or by others approved by them; and that, in order to secure the confidence and respect of teachers, and the ultimate success of the measure, it is necessary that the examiners be persons of practical experience in teaching."

5. "That this meeting regards the proposal to place 'registered' schools on an equality with endowed schools, and to entitle them to compete for exhibitions on certain conditions, as sound in principle, and as designed to effect much good by upholding and advancing existing institutions."

6. "That this meeting rejoices to find in the Bill a considerable, if not a full, recognition of the claims of girls' schools to an equality of position with boys' schools."

Notice of any amendment must be sent to Mr. Barrow Rule, hon. secretary of the Scholastic Registration Association, Boswell-house, Croydon, on or before Friday, 7th of January, 1870, for the consideration of the committee.

THE NEW CAB REGULATIONS.

A meeting of the hackney-carriage proprietors was held on Tuesday last, in Cambridge Hall, Newman-street, to consider the new rules and regulations as submitted by Colonel Henderson, the Chief Commissioner of Police. The meeting was called by the Amalgamated Association of Cab Proprietors, and was requested to express an opinion on the following points:—

1. Hackney-carriage licence; the price, and time allowed for obtaining the same.
2. Hackney-carriage inspection; nature of the same, and when to be inspected.
3. Table of fares; what plan or pattern, and what rate of fares, and on what part of the cab to be placed.
4. A licensed number of persons to carry, and not allowed to recover the fare for more.
5. Luggage; a "reasonable quantity" to be defined.
6. Property found in cabs; a reward for the same.
7. The lamp, and where to fix it.

Mr. J. S. CROCKER, secretary to the association, detailed what had passed on these questions between himself and the Chief Commissioner of Police, and submitted the following suggestions as proposals from him:—

1. Licenses (£2 each) be issued on and after the 1st January, 1870.
2. The inspection will, on this occasion, merely be made to see that the cabs are reasonably fit for public use.
3. In a month to be hereafter fixed, the regular inspection will be made.
4. The existing rate of fares will be continued during the month of January.
5. On the 1st of February next, each cab to be provided with a plate, of a pattern to be seen at Scotland-yard, showing the rate of fare per mile and per hour at which it is proposed to ply for hire.

The general feeling of the meeting was in favour of these suggestions. It was unanimously agreed that a metal flag, to be displayed from the top of the cab as an indicator that it was for hire, would be the best form of announcing the fare; and the meeting agreed that, for the present cabs, the present fares should be adopted, with the following modifications:—No fare under one shilling; hansoms to charge half-a-crown an hour, when engaged by time; children to be paid for as adults; and luggage outside always to be paid for. The four-mile radius to be reckoned along the roads, and a shilling a-mile to be charged under all circumstances beyond it. The inspection of the cabs to be in September, and the lamp not to be insisted on. The tone of the meeting was hopeful as to the prospects of the trade, under the regulations which will be issued in pursuance of the Act of last session.

Commerce.

THE FRENCH TREATY.—Mr. Shaw Lefevre, Vice-President of the Board of Trade, addressed a meeting of merchants in Liverpool, on Monday, the 29th ult. He explained the Merchant Shipping Bill, which is to be proposed next session. He said that the repeal of the French Treaty would be a great misfortune to England. But there was no fear of such a course being taken. France had treaties similar to that with this country with almost every European government, and it would be almost against the comity of nations to abrogate the treaty with us while some of the treaties with other countries had five or six years to run. There was no objection to an inquiry into its operation, but it must be complete, and not partial.

Colonies.

ALOE FIBRE IN MAURITIUS.—Another article of colonial production which has for years past, from time to time, attracted public notice, seems now to have some

chance of assuming, ere very long, an important place in the exports of Mauritius. This is aloe fibre, which is now being extracted for exportation by several persons; and in Bourbon, where sugar planting has ever been less successful than Mauritius, a still larger amount of attention has been bestowed on this fibre; and machines have been erected in several places, capable of beating out 1,000 lb. of it per diem. The aloe (that known as the Yucca) grows wild in immense numbers on the mountains of these islands; and, like all species of aloes, it is very hardy, being little affected by dry seasons. The fibre is worth £25 to £30 per ton in Europe, and it is believed that it will gradually become an article of considerable importance in the colony.

THE AGRICULTURAL SOCIETY OF NEW SOUTH WALES is progressing. Negotiations are being made between the Corporation of Sydney and the Society with reference to the erection of a large building in the Alfred-park.

Notes.

BAVARIAN FETES.—It is said that the King of Bavaria intends to establish literary, scientific, artistic, and industrial prizes, to be competed for at the annual fêtes, which usually take place in the month of October.

SILK SUPPLY ASSOCIATION.—The offices of this association, referred to in Mr. Dickens' paper "On Silk Supply," read before the Society on the 24th November, are at 3, Castle-street, Holborn, where all communications should be addressed.

Correspondence.

PRINTS AND THEIR PRODUCTION.—SIR,—Finding that what I have stated in reference to the production of photographic surface-blocks for printing has been misunderstood, as I appear to imply that Mr. Linton alone has produced such blocks successfully, I shall be glad to be allowed to correct any such misapprehension. What I desired to say was, that of the various processes with which I was acquainted, the most satisfactory results had been attained by the processes of Mr. Hancock and Mr. Linton, and not exclusively by the last-named gentleman. Mr. Hancock claims to be the only producer of surface-blocks by electro-photography. Messrs. Day and Haghe should have been referred to in my paper as among the very earliest producers of colour-printing by means of lithography. Roberts' "Holy Land" and "The Siege of Jerusalem" may be mentioned as among their productions; "and Blue Lights," produced in 1851, after the well-known picture by Turner, was the work of the same firm, which was then known as Messrs. Day and Sons. Various other works produced by them, such as Owen Jones's "Grammar of Ornament," "The Manchester Art Treasures," and "Wyatt's Metal Work," will be remembered by all who have watched the progress of the art.—I am., &c., S. T. DAVENPORT.

ANGLO-FRENCH COMMUNICATION.—SIR,—Mr. Austin objects, not probably without cause, to the small capacity for railway traffic of a single channel tube, worked on the atmospheric or other principle. But one train, in either direction, could be permitted in the tube at one time, and not less than three-quarters of an hour would probably be consumed in traversing the twenty-one miles, including the time occupied in entering and delivering the train clear of the divergent lines at either end, on which other trains were coming out or waiting to start. Practically there could be but one train each way in every two hours, or twelve trains each way daily. Were each train to carry one hundred passengers, on the average there would be 16,800 passengers weekly, or nearly 875,000 per annum, and, with an average charge of 5s. per passenger for the

twenty-one miles, this would return £210 per mile per week, nearly equal to the interest upon the cost of the work, if estimated at £6,000,000. It should be added that constant telegraphic communication from end to end would be maintained by submarine cables laid alongside. If there be any objection to the atmospheric system it is that the trains are pushed instead of pulled, although even a train of twenty carriages might probably be pushed with safety through a tube of a section hardly larger than their own.—I am, &c., ZERAH COLBURN.

December 14th.

MEETINGS FOR THE ENSUING WEEK.

- MON.....Society of Arts, 8. Cantor Lecture. Mr. J. Norman Lockyer, F.R.S., "On the Spectroscope and its Applications."
- Actuaries, 7. Mr. T. B. Sprague, "On the Rate of Mortality prevailing among Assured Lives, as influenced by the Length of Time for which they have been Assured."
- Society of Engineers, 7. Adjourned discussion upon Mr. Vaughan Pendred's paper, "On Apparatus for Measuring the Velocity of Ships."
- Social Science Assoc., 8. Mr. Edwin Pears, "On Grade Schools, and on Scholarships between Primary and Grade Schools and the Universities."
- Medical, 8.
- Asiatic, 3.
- London Inst., 4.
- TUES ...Civil Engineers, 8. Annual Meeting.
- Statistical, 8. 1. Mr. Samuel Brown, "Report on the International Statistical Congress of 1869." 2. Mr. R. H. J. Palgrave, "House Accommodation in England, in relation to the Census of 1871."
- Pathological, 8.
- Ethnological, 8. 1. Prof. Busk, "On an Ancient Calvaria, assigned to Confucius." 2. Major Millingen, "On the Koords and Armenians." 3. Dr. Gustav Oppert, "On the Kitar and Kara-Kitai."
- WED ...Society of Arts, 8. Dr. J. L. W. Thudichum, "On Wines, their Origin, Nature, Analysis, and Uses; with special reference to a new Alcoholic Drink made from Tea."
- Geological, 8. 1. Messrs. Ralph Tate and J. S. Holden, "On the Iron-ores associated with the Basalts of the North-east of Ireland." 2. Mr. J. W. Hulke, "Note on the Skull of the Large Kimberidge Crocodilian, *Dakosaurus maximus*, Quenstedt, *Steneosaurus*, Geoffr. St. Hilaire." 3. Mr. J. W. Hulke, "Note on a Fragment of a Jaw with peculiar Teeth from Kimberidge Bay." 4. Principal Dawson, "Notes on the Structure of *Sigillaria*." 5. Principal Dawson (of Montreal), "Notes on some new Animal Remains from the Carboniferous and Devonian of Canada."
- R. Society of Literature, 8½.
- THUR ...Antiquaries, 8½.

Patents.

From Commissioners of Patents' Journal, December 10.

GRANTS OF PROVISIONAL PROTECTION.

- Blast furnaces, removal of dross out of—3321—G. B. d'Adelswärd.
- Boxes—3443—S. J. J., and L. H. Perry.
- Bricks, &c., machinery for making—3291—F. Clark.
- Buckles—3413—J. Keats.
- Buckles and clasps—3438—A. E. Loram.
- Card for facilitating the withdrawal of single threads for sewing purposes—3421—S. Tatton.
- Carding engines, machinery for feeding—3465—B. Acton and J. Mustard.
- Chaff, &c., machinery for cutting—3449—J. Tester.
- Clothes lines, supporting—3366—G. H. Wilkes.
- Condensers, &c.—3432—A. Barclay.
- Cooking, toasting, and roasting apparatus—3448—J. Williams, jun.
- Cork-cutting machines—3485—G. Hammer.
- Cots or bedsteads—3461—C. H. Hudson.
- Cotton, &c., preventing roller laps on roller ends of machines for carding—3455—J. Edwards and J. Quin.
- Earthenware articles, &c., appliances used in manufacturing—3473—T. G. Green.
- Elliptic springs—3462—E. T. Hughes.
- Fire-arms and cartridges—3481—W. Richards.
- Flax, &c., machinery for hatching—3425—J. Combe.
- Friction engine for producing motive-power—3392—W. Strigley.
- Fuses, &c.—3424—W. Perkins.
- Games, &c., apparatus for registering the points of—3464—W. H. Willis.
- Grain, machinery for cleaning, &c.—3357—A. B. Childs.
- Graphoscopes—3440—G. Lockett.
- Hats, &c., ventilating—3460—J., J., and W. H. Wood.
- Hides and skins, apparatus used in tanning—3453—H. Draper.
- Horticultural and other buildings, &c.—3457—W. Parham.
- Hydraulic cranes—3409—B. Johnson and E. B. Ellington.
- Indicators for marking games of chance, &c.—3381—E. Round.

- Ink bottles, &c.—3407—E. F. Goodall.
- Iron—3247—J. P. Budd.
- Kilns for burning pottery, &c.—3467—E. Ensor, jun.
- Letters, &c., apparatus for stamping—3475—J. James.
- Lock fastenings for expanding cases, &c.—3436—W. Johnson.
- Locomotive engines, &c.—3403—F. W. Webb.
- Lubricators—3348—L. Folliet.
- Meat, preserving—3428—S. Wyatt.
- Men's wearing apparel, adjusting—3429—H. S. Freeman.
- Metal heads, manufacturing—3350—J. Belicard.
- Metal sheets, &c., machinery for cutting—3454—G. & A. B. Marquis.
- Metallic barrels—3422—E. H. Burke.
- Metals, &c., machinery for shaping, &c.—3434—J., J., E., and W. Pitt.
- Millstones, balancing—3447—E. Lethbridge.
- Millstones, dressing—3459—W. H. Shaw and J. M. Audus.
- Mortar mills, &c.—3419—J. Fletcher, sen., J. Fletcher, jun., and W. Fletcher.
- Motive-power, obtaining—3452—J. C. Mewburn.
- Paint and varnish, manufacturing—3335—G. F. Cornelius.
- Paper pulp, apparatus for straining—3433—G. Bertram and M. Paterson.
- Paper pulp, manufacturing—3418—J. Denis.
- Phenol, &c., making a new derivative of—3451—T. Reissig.
- Powder for destroying the oldium in vines, &c.—3415—W. E. Gedge.
- Railway axle-boxes, lids for—3423—B. Wood.
- Railway points and signals, working and locking—3427—J. Brunton.
- Reaping and mowing machines—3471—R. Hornsby & J. E. Phillips.
- Reels, bobbins, &c.—3420—S. Tatton.
- Rocks, &c., machinery for boring—3411—T. Brown.
- Rotary motion, converting reciprocating motion into—3468—A. V. Newton.
- Shawls—3439—W. Cross.
- Show cards, &c.—3426—A. C. Engert.
- Sponge, rendering suitable for stuffing beds, &c.—3477—J. T. Griffin.
- Standing crops, cutting and collecting—3437—J. Howard and E. T. Bousfield.
- Steam engine governors—3483—R. Robey and J. Richardson.
- Stone, &c., apparatus for dressing—3435—L. Pochet.
- Tank filters, &c.—3470—J. F. Crease.
- Treenails, bobbins, &c., boring, &c.—3444—S. Fox and J. Reffitt.
- Turbines, &c., regulating the supply of water to—3016—A. H. Douché.
- Umbrellas and parasols—3466—W. Avery.
- Varnish and varnish paints—3417—D. Barker.
- Velocipedes—2733—M. Doirier.
- Velocipedes—3197—W. E. Gedge.
- Vent plugs—3450—E. Oades.
- Water, &c., meters for measuring—3463—A. W. Pocock.
- Water-closets—3479—F. N. Target.
- Wood and metals, machine for shaping, &c.—3275—W. E. Gedge.
- Wool, &c., machinery for preparing, &c.—3430—F. Preston.
- Worsted, &c., spinning, &c.—3458—J. Speight.
- Yarns and threads, machinery for polishing—3405—J. Nichols.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

- Fluid lenses—3515—W. Brewster.
- Grain or seed, machinery for hulling—3527—W. R. Lake.
- Metals and magnetic substances, separating from other bodies—3538—C. Yavin.
- Mortising, tenoning, and sawing machines—3509—J. F. Kent.

PATENTS SEALED.

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|-------------------------------------|-------------------------------|
| 1810. J. H. Riddell. | 1872. J. G. Tongue. |
| 1816. E. G. Brewer. | 1920. A. M. Clark. |
| 1818. J. Taylor. | 2317. F. A. Yeo and H. Hanna. |
| 1819. W. S. Underhill and J. Smith. | 2441. J. Blyde. |
| 1821. J. Young. | 2539. A. Moncrieff. |
| 1834. J. Lindley. | 2613. F. Armstrong. |
| 1840. J. T. Masbon. | 2911. J. F. M. Pollock. |
| 1854. E. Cardon. | 2929. J. Fearson. |
| 1864. W. McNabb. | 2963. M. Andrew. |
| | 3003. J. Mackie. |

From Commissioners of Patents' Journal, December 14.

PATENTS SEALED.

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|----------------------------|----------------------------------|
| 1842. H. Tylor. | 2047. R. Mallet. |
| 1849. W. R. Lake. | 2054. J. H. Johnson. |
| 1853. W. Woofe. | 2212. J. H. Johnson. |
| 1855. T. Routledge. | 2264. B. Hunt. |
| 1860. W. R. Lake. | 2784. J. W. Morgan. |
| 1866. J. H. Johnson. | 2976. T. Parry and J. McHardy. |
| 1867. C. and E. Brightman. | 2995. J. Taft and J. C. Edwards. |
| 1881. T. Silver. | 3048. J. H. Johnson. |
| 2037. W. Bray. | 3054. J. Scharr. |

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

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|------------------------------------|----------------------------------|
| 3228. W. Clark. | 3328. W. R. Lake. |
| 3255. W. Hopkinson. | 3262. R. B. Boyman. |
| 3438. G. Shrewsbury. | 3265. S. Chatwood. |
| 3247. W. F. Smith and A. Coventry. | 3288. H. Brinsmead. |
| 3299. G. Bertram. | 3405. W. Clark. |
| 3449. C. F. Flach. | 3432. G. Payne. |
| 3253. W. E. Newton. | 3273. C. E. Brooman. |
| | 3292. T. V. Morgan and E. Hyles. |

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

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|--------------------|-------------------|
| 3281. W. Palliser. | 3384. J. Clayton. |
| 3300. G. Jeffries. | |